Metacognition in year one : an exploration of metagognition in five and six year old children during a cognition acceleration programme

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An Exploration of Metacognition in Five and Six Year Old Children During a Cognitive Acceleration Programme

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Abstract

Metacognition is a higher level of cognition, consisting of stored metacognitive knowledge and monitoring and control processes. Theoretical models of metacognition tend to view it as late developing. This project investigated the possibility of facilitating metacognition in five and six year old children during a cognitive acceleration programme (CASE@KS1).

A quasi-experimental approach, consisting of pre- and post tests measured the development of metacognition in 24 year one children in four CASE schools and 18 year one children in 3 matched control schools. Results of the tests indicated that the CASE programme had a positive effect on metamemory and interpretative theory of mind. Test results suggested that metacognition may not be a unified phenomenon, but consist of different factors, with their own developmental tracks. Qualitative data from the tests was subject to a phenomenological analysis to provide descriptions of metacognition from the child's perspective.

Over 60 classroom observations of CASE tasks and numeracy lessons resulted in a unique coding system of teacher and child metacognitive behaviours. Frequency counts of these behaviours showed that CASE lessons had more and a greater spread of metacognitive behaviour than numeracy lessons in either the experimental or control schools. Three case studies revealed complex interactions between the classroom environment, the task, collaborative groups and individual social and cognitive factors. Teachers' knowledge, opinions and beliefs about metacognition, learning and early years pedagogy were also found to impact on the facilitation of metacognition in the classroom.

Factors which could influence the creation of metacognitive environments in early years education are discussed. Avenues for future research into metacognition are identified including the use of phenomenological analysis to gain a greater understanding of metacognition in young children.

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Chapter 1

RESEARCH CONTEXT – A PERSONAL JOURNEY

1 INTRODUCTION

A seventeen year old boy sits forlornly at the back of an English class, staring blankly at the work before him. The task is to construct an advertisement, writing the copy and suggesting an illustration for any teenage product. The work follows on from two lessons on the media and advertising where all aspects of advertising including, style, message and medium have been discussed. When the teacher asks why he isn't progressing with the work all the boy can say is because "I'm stuck". Further probing by the teacher reveals that the boy doesn't know why he is stuck. On his own he is unable to make the link between the real advertisements he has *seen and the task he is now set. He is unable to begin to plan how he is going to do it and he is unaware of what he already knows about the subject.*

A four year old is shown a tube of sweets and asked what it contains. The child answers sweets. A researcher shows that in fact the tube contains crayons and then asks the child what a friend who has only seen the tube would say it contained. The child answers "crayons".

What is the link between these two scenarios? Firstly, there is a fifteen year gap between the first event and the second event. Secondly, I was involved in both cases, in the first instance as a newly qualified teacher of English and Communications working in a Further Education College and in the second instance, as an educational researcher on this project. Thirdly, both scenarios felt uncomfortable, albeit to different degrees. This feeling is probably recognised by all teachers, who have struggled to understand why their students are unable to see or understand what has been explained to them, or what appears to be obvious. For some teachers, repeated exposure to this feeling can lead to frustration and from there to a tendency to generalise as in "my children just don't think" (a teacher from this project). Yet another factor that these two events have in common, is that both "students", the seventeen year old and the four year old, were of average intelligence for their age, neither had any specific learning disability, both had English as a first language and had normal language development.

However, what really links these two events, is that both students were not failing because of cognitive skills, but because of higher level thought processes or metacognition. The two scenarios differ in that the seventeen year old is displaying a failure of particular metacognitive abilities. These include metacomprehension, (understanding whether or not you understand something), metacognitive skill, (planning or thinking of how to approach a problem), metacognitive knowledge, (knowing what you already know) and meta-reasoning skills (testing possible solutions and monitoring progress). The four year old is displaying a failure of theory of mind, (understanding that other people have their own thoughts). All the above are aspects of metacognition. In these two scenarios, the four year old is in the more favourable position, as theory of mind tends to develop with age and without overt instruction, whereas the other aspects of metacognition are less likely to develop without some kind of help.

Like many teachers, fifteen years ago I was unaware that some of my adolescent students whilst bright and motivated, were still unable to be self-reliant in terms of their own work. They misjudged the time needed to complete a piece of work and they seemed to lack study skills, although these were taught. They consistently failed to answer the question set, whilst failing to realise that this is what they were doing. It seemed that something had been missed from their years of education. How had they got to a post school environment, taking advanced level subjects without these skills? It was difficult to begin to address these problems, whilst trying to cover the material content necessary to pass an external examination in a limited time. Thus it seemed to me then, that an earlier intervention with younger children might have more chance of success and ensure that the higher level of cognitive skills was nurtured, along with the necessary skills relevant to curriculum areas.

2 CASE@KS1 THEORY

In 1999, the opportunity arose to study the impact of one such intervention called Cognitive Acceleration Through Science Education at Key Stage One (hereafter called CASE@KS1). The CASE@KS1 programme is based on Piagetian theories of stage development (Piaget & Inhelder, 1969) and Vgotskyan theories of social construction of knowledge (Vygotsky, 1978). It aims, through collaborative group work and problem solving to accelerate the development of concrete operational thinking in five to six year old children.

Research comparing expert and novice problem solvers has shown that they tend to differ in the extent and range of metacognitive processing they use, (Chi, Feltovich, & Glaser, 1980; Chi, Glaser, & Rees, 1982). Expert problem solvers across different domains were found to employ metacognitive strategies such as planning, monitoring, checking, reflecting and making analogies, (Linn, 1986). The CASE@KS1 programme involves children working in groups of six to solve a problem designed around Piagetian schema of seriation, classification, points of view and causality. There are twenty-eight activities and each activity takes around thirty minutes to work through, (Adey, Robertson, & Venville, 2001). A typical year one class of thirty children is divided into five groups of six children each (a CASE@KS1 focus group). There is one activity for each week of the school year, excluding weeks at the beginning and end of the term. Each CASE@KS1 focus group works on that week's activity with their teacher, for thirty minutes. The groups are rotated, so that the same focus group does not always do the week's activity on the same day of the week. The activities are structured around the five pillars of CASE theory. These are concrete preparation, cognitive conflict, social construction, metacognition and bridging, (Adey, 2002). In terms of CASE theory these pillars have been defined as follows : (Edited from (Shayer & Adey, 2002)

2.1 Concrete Preparation

Introduction to the problem including its context and the vocabulary it requires. All children should be engaged with the task and the teacher should begin to "induce in the students the learning behaviour they are to work with in the second (construction) phase of the activity". (p.5)

2.2 Cognitive Conflict

This involves the Piagetian idea of equilibration, which CASE describes as the "process by which cognitive processing mechanisms in the mind accommodate to events which cannot readily be assimilated and which create some sort of cognitive conflict". (p.5). It also involves the Vygotskyan idea of a zone of proximal development, which is the difference between what someone can do with support and what they can do unaided. Cognitive conflict is created by providing cognitive challenges of moderate difficulty and support in the form of collaborative group work, a teacher/leader and group discussion.

2.3 Social Construction

This draws on the Vygotskyan idea that knowledge and understanding is firstly constructed socially and then internalised by the individual. It takes account of Piaget's view of the importance of the social context, in the development of cognition. The children are encouraged to describe and explain their ideas, to collaborate with others and to explore new ideas, through group discussion and listening to others.

2.4 Metacognition

As described by CASE theory it involves children "becoming conscious of their own thinking and developing and practicing the technical vocabulary necessary for describing different thinking actions" (p.6). In terms of CASE theory it is a process that takes place subsequent to a cognitive act.

This is a very limited view of metacognition and whilst it forms the basis of the way metacognition was introduced to participants engaged in the CASE programmes, it only begins to scratch the surface of what metacognition is. It was, however, the starting point for this research project and forms a part of the context in which this project is embedded.

2.5 Bridging

This involves making new thought processes useful in different contexts. Children on the programme are asked to link what they have learnt about one schema, to other areas, where that knowledge may become useful.

CASE@KS1 as a project, includes a set of activities and materials designed to facilitate these "pillars", by providing opportunities for cognitive conflict, social construction and metacognition. The project included a professional development programme for the teachers. This aimed to help them to develop the pedagogy characteristic of cognitive acceleration. This involves focusing on the schemata of concrete operations and managing cognitive conflict, promoting social construction and metacognition, through scaffolding and questioning. The facilitation of metacognition is in the pedagogy, not simply in the activities. For further information on the professional development programme, see (Adey, Hewitt, Hewitt, & Landau, 2004).

3 CASE@KS1 PROJECT

The CASE@KS1 project began with a developmental year in one London Borough in 1998-99. The main intervention project began in September 1999 in ten schools (fourteen year one classes), within that Borough. A control group of five schools (eight year one classes), was selected from the same area and matched as far as possible in terms of social and demographic characteristics. The project was funded from a single regeneration budget, allocated to that local education authority. The main project took a quasi-experimental design, to test whether the development of concrete operational thinking could be accelerated by this intervention. The evaluation relied largely on the statistical results of a series of pre- and post intervention tests of conservation, administered to a one third stratified sample, a drawing test of spatial ability given to all the children and a post test of Ravens matrices also given to all the children. There was also a comprehensive programme of training the teachers in CASE theory and method, which included both in class support and external workshops. This programme of professional development was also evaluated, (Adey et al., 2004). In 2001 results of the statistical analyses of these tests for the main CASE@KS1 project were available and these showed a significant effect for the intervention classes over the control classes, (Adey, Robertson, & Venville, 2002).

4 FORMULATION OF RESEARCH QUESTIONS

The CASE@KS1 project provided a very good opportunity to research metacognition and its connection to cognitive development and academic success. The initial research questions were formed under the influence of the paradigm adopted by the main project. These were:

1. Can metacognitive ability be enhanced?
2. Are metacognitive gains related to cognitive/academic gains?

3. How is metacognition facilitated in year one classrooms?
4. What factors, associated with teachers, impact on the development of metacognition in year one classrooms?

These research questions are looking at change and the effect of one aspect of the CASE@KS1 programme. Thus a quasi-experimental design, which paralleled that of the main project, was adopted. The intention was to measure the development of metacognition in a sample of children from the CASE@KS1 experimental schools and compare this, with the development of metacognition, in a sample from the CASE@KS1 control schools.

However, this proved to be problematic. Firstly, a review of the literature on metacognition, (See chapter 2) showed that the CASE definition was over simplified. Different definitions have been put forward by different groups of psychologists. Educationalists and philosophers have also contributed theories of metacognition and there remain many contested aspects of definition. Secondly, attempts to measure metacognition have been fraught with issues of reliability and validity and there are still no uncontested comprehensive standardised measures for this age group. Thirdly, the majority of studies of metacognition are done with older children or adults, because the age at which metacognition is thought to be possible is still disputed, but there is a tendency to link it to the development of other cognitive processes and a certain level of language development. These issues are returned to throughout this project. In addition to this, few studies of metacognition are able to take into account the social and emotional contextual factors that a project based within an educational setting must do. Thus, for this project, the role and influence of significant adults, in this case teachers, on the development of metacognition, is also investigated. Finally, this project appears, to date, to be unique in its attempt to describe what metacognition feels like for the five and six year old children who participated. The majority of published research on metacognition takes a definition of metacognition from the extant literature and whilst this project also does this, as delineated in chapter 2, it goes one step further. It attempts a phenomenological description of different aspects of metacognition, in order to understand what it means to be metacognitive at the age of five to six years old.

Thus, this project combines both quantitative and qualitative methods. The quantitative methods attempt to measure the development of metacognition of a sample of the participating children, over one academic year. The qualitative methods provide an original approach to describing metacognition from the children's perspectives, and an analysis of social and contextual factors. Throughout this thesis problematic issues concerning metacognition are returned to.

5 OUTLINE OF THE THESIS

Firstly, chapter 2 outlines the various theories of metacognition that have been put forward since the 1970s, and explains the decision to base this research on the developmental psychology perspective of John Flavell's theory of metacognition, (Flavell, 1979). However, other more recent theories have influenced this work and these are also discussed. During the last six years, (the time scale of this project), there has been a consistent interest in metacognition from psychologists, educationalists and philosophers. Chapter 2 also reviews some of this more recent literature and describes the state of research on metacognition today.

Following this discussion of the issues and problems with research into metacognition, chapter 3 goes on to describe the research questions for this project in more detail. The design of the project is outlined and related to each of the research questions. Issues of measurement, language and project ethics are also discussed. Chapter 4 gives an account of a pilot project undertaken in early 1999 and describes how this affected the design of the full project. The limitations and constraints of the design and methods used are discussed, along with wider issues of undertaking an investigation in a real setting, within a network of complex and interacting contextual factors.

A particularly original feature of this research is an attempt to use a phenomenological description of the children's reflections on different aspects of cognition. Chapter 5 explains why and how this method was adopted and presents a step by step description of the method in use.

Chapter 6 presents the four tests of metacognition, which in line with the quasi-experimental approach, were administered to all the sample of children as pre- and post intervention tests. The tests are explained individually and quantitative results are given. The test data is then used to provide phenomenological descriptions of these aspects of metacognition, as explained in chapter 5. Finally, the quantitative results from the four tests are correlated using Spearman Rank Correlation, with each other and with the results of tests from the main CASE@KS1 project. The results are discussed in the light of the research questions and links are made back to the theories delineated in chapter 2 and forward to the contextual factors examined in future chapters.

Over the year of this project, the children in the experimental schools were observed working on CASE@KS1 activities in situ and during numeracy hour lessons. Children from the control schools were also observed during numeracy hour lessons. Chapter 7 presents a new method of categorising children and teacher behaviours as metacognitive, based on Flavell's theory of metacognition (Flavell, 1979). This method is fully explained and examples of the analysis are shown. Frequency counts of the instances in different categories are made, in order to compare the metacognitive behaviour of teachers and children during CASE@KS1 activities, with their metacognitive behaviour during numeracy lessons. This method is also used to compare the metacognitive behaviour of teachers and children in the experimental schools, with those in the control schools. Issues of reliability and validity are also discussed.

Whilst chapter 7 examines metacognition as demonstrated in a group setting, chapter 8 focuses in on three individual children and tracks the development of their individual metacognition over the year and the extent to which the group has influenced this.

The focus of this research project is the development of metacognition in five to six year old children. However, the underlying assumption to the project, is that metacognition does not develop in isolation, but within a network of contextual factors. Since this project has an educational setting, arguably the most important factor, other than the children, is the teacher and the CASE@KS1 project sets great store by its professional development programme for teachers.

Chapter 9 of this thesis focuses more on the teachers and reports a qualitative analysis of semi-structured interviews undertaken with the eight participating teachers at the beginning and end of the intervention year. An important aspect of these interviews is asking the teachers about their own metacognition, as well as about their pedagogic role, in terms of facilitating metacognition in the children. Wider methodological issues around conducting face to face interviews are discussed and the particular structured method of analysis is explained and justified.

Chapter 10 firstly outlines the findings of all the different aspects of this project. The quantitative results of the four tests of metacognition; the findings from the phenomenological descriptions; the teachers' and children's metacognitive behaviour during observed periods in the classroom; the findings of the case study analyses of three individual children tracked over the year and the issues arising from interviews with the teachers are summarised. These findings are then discussed in the light of the initial research questions and in the context of extant theories of metacognition.

In the conclusion the discussion is widened to show what new insights have been discovered about the development of metacognition in young children. Some further problems with research in this area are highlighted, in the context of very recent published papers on the topic. The influence, of the findings from this project, on the state of research into metacognition in general, is discussed and future directions are outlined.

Chapter 2

DEFINITIONS AND RELATIONSHIPS OF METACOGNITION WITH OTHER CONSTRUCTS

1 INTRODUCTION

This chapter describes and discusses the theoretical underpinnings for this project. Section 2.1 presents issues surrounding the definition of metacognition and then introduces John Flavell's theoretical model of metacognition on which this project is based. This model is compared with other models of metacognition and related concepts of self-regulation and cognitive models of intelligence are discussed.

The extent to which cognition and metacognition are separate and how they interact has been an issue in research on metacognition from the beginning.

Section 3 reviews the literature on this and introduces many of the problems researchers have faced in investigating these links.

Section 4 introduces the concept of theory of mind, which is a particularly important aspect of the development of metacognition in young children. Different theoretical perspectives on the development of theory of mind are discussed in the light of its centrality to metacognition.

In Section 5 the literature on metacognition is brought up to date, with an exploration of research on metacognition over the last six years, (the length of this project). Trends are identified, the state of research on metacognition today is discussed and future lines of inquiry are suggested.

The conclusion shows how the literature has influenced the research questions for this project both theoretically and in terms of methodological problems and issues.

2 DEFINITIONS AND MODELS OF METACOGNITION

2.1 Introduction

Most commonly, the term metacognition is used to refer to knowledge about cognition and monitoring and control of cognition. Yet this simple definition does an injustice to the large amount of theoretical, conceptual and empirical work that has been carried out to attempt clarification of a concept, which has been bedeviled by definitional problems since the word was first coined in the 1970's.

Some of these problems arise out of the original conceptualization, whilst others are more clearly linked with measurement issues. A major theoretical problem, which will be discussed here, is the extent to which metacognition is a conscious act. This is inextricably linked to the other problematic areas of automatic versus controlled processing; the nature of executive functions; abstraction and reflection; self regulation and regulation by others. The other problems, which are linked to measurement, include introspection, verbal reports as data, and validity of measurement instruments; these will be discussed in chapter 6.

One of the definitional problems of modern research on metacognition arises out of the confusion between metamemory and metacognition. In 1971 as discussant to a symposium on memory where the term metamemory was first used, Flavell made a clear link between memory and cognition. Agreeing with Piaget, on the concept of memory as "another mode of knowledge [which] cannot be dissociated from intelligence" (Piaget, Inhelder, & Sinclair-de-Zwart, 1968), Flavell comments: "if memory itself is mostly applied cognition then memory development must largely be applied cognitive development" (Flavell, 1971). Citing Hagan's work on the growing consciousness of the child and development of self-awareness, Flavell concludes by defining memory development:

> "it seems in large part to be the development of intelligent structuring and storage of input, of intelligent search and retrieval operations and of intelligent monitoring and knowledge of these storage and retrieval operations – a kind of meta-memory". (Flavell, 1971)p.277

Whilst this refers specifically to metamemory, it seems clear that Flavell sees memory as a form of cognition and thus metamemory is a form of metacognition, which has memory as its object; similarly we could make the same case for metacomprehension.

2.2 Flavell's Model

Flavell's developmental model of metacognition (Flavell, 1979) states that monitoring of cognition comes about from the action and interaction of four distinct classes of phenomena: metacognitive knowledge, metacognitive experience, goals (or tasks), actions (or strategies).

Metacognitive knowledge is described as stored knowledge about one's own and others' cognitive processes and knowledge or beliefs about the factors that act and interact to affect cognition. These variables are described in three categories: person, task and strategy. The person variable contains everything you know about people as cognitive beings including beliefs about differences in cognition between individuals; differences in the individual between tasks, and a concept of the "universals of cognition" i.e. types of understanding which include attending, problem solving and communicating. The person variable of metacognitive knowledge interacts with the task variable. The task variable too, includes sub categories including a) the information available about the task and how that impacts on how the task should be managed and leads to predictions of success and b) metacognitive knowledge about the task goal i.e. that some tasks are easier than others. The strategy variable of metacognitive knowledge contains the knowledge about what strategies are likely to be effective in achieving different goals. However, often confused here is the distinction between cognitive strategies and metacognitive ones. It seems clear from Flavell's model that the stored metacognitive knowledge includes strategies and when to employ them

> "Cognitive strategies are invoked to make cognitive progress, metacognitive strategies to monitor it" (Flavell, 1979)p.909

However, the distinction is not always clear and the same strategy can achieve both goals. For instance, Flavell provides the example of studying for an exam where, when wondering if you know the material well enough to pass the exam, you may monitor your progress by testing yourself, this is a metacognitive strategy aimed at assessing your knowledge and monitoring your learning. However, this strategy with a metacognitive intention may also result in you acquiring more knowledge and thus the strategy serves a cognitive function as well.

Metacognitive knowledge then is stored in long term memory and concerns the interactions of three variables: person, task and strategy. Flavell argues that in this sense metacognitive knowledge is similar to other knowledge stored in long term memory and thus can be activated by a deliberate conscious search or by unintentional automatic retrieval cues provided by the goal.

> "However activated, it may and probably often does influence the course of the cognitive enterprise without itself entering consciousness" (Flavell, 1979)p.907

This is an important point to remember about Flavell's model, that metacognitive knowledge affects cognition unconsciously as well as giving rise to a conscious experience (which Flavell calls a metacognitive experience). Thus the theoretical model which underpins this project differs from the CASE@KS1 definition of metacognition, which requires it to be a conscious process. Whether fully conscious, available to consciousness or unconscious it seems that metacognitive knowledge leads us to evaluate and act in the light of the interactions between goals, tasks and strategies and further, metacognitive knowledge helps to interpret the meaning and implications of metacognitive experiences.

A distinction is made by Flavell between metacognitive experiences which arise out of metacognitive knowledge that has become conscious e.g. remembering a similar problem to the one you are working on and metacognitive experiences described as feelings, for instance, that you are far from solving the problem. Acting on this feeling will however be guided by your metacognitive knowledge. Thus metacognitive experiences of feelings of puzzlement or failure can have far reaching effects on the cognitive goal, maybe leading to abandoning it. In addition, metacognitive experiences add to or revise the metacognitive knowledge base. Metacognitive experiences then are influential in developing the metacognitive knowledge base and in ongoing cognitive enterprises. The implications of this are that we should facilitate and encourage metacognitive experiences for children, if we believe that development of a rich metacognitive knowledge base is important for learning. Flavell's model of metacognition is important because it stipulates the conditions under which metacognitive experiences may occur:

> "... in situations that stimulate a lot of careful, highly conscious thinking: in a job or school task that expressly demands that kind of thinking; in novel roles or situations, where every major step you take requires planning beforehand and evaluation afterwards; where decisions and actions are at once weighty and risky; where high affective arousal or other inhibitors of reflective thinking are absent" (Flavell, 1979)p. 908

Of all the models of metacognition discussed in this section, Flavell's model indicates how metacognition can develop and suggests implications for education. This developmental perspective seems most pertinent for this project. Whilst Flavell worries about educational interventions, which may promote metacognition to excess, he concludes that the risk of becoming so analytical that one is effectively paralysed is slight, compared to the risk of ignoring the development of this area of mental activity. In more recent work Flavell (Flavell, 2000) has shown developmental differences between 4,5,6,7,8 and 10 year olds in areas of awareness of psychological activity. For instance 4 year olds believed that a person could be attending to two unrelated things at the same time, whereas 6 and 8 year olds demonstrated an understanding that attentive thought is selectively focussed. Flavell suggests that the younger child may conceive of the mind as like a lamp able to radiate thought in many directions at once, rather than as a flashlight. A further study showed that whilst 5 year olds realise that if a person is doing a mentally challenging activity he is likely to be thinking of that activity, they are less aware that if the task is an automatic one, a person's thoughts can be elsewhere.

The studies show a marked developmental progression during these ages regarding understanding of mental activity. When asked if someone could go for three days without thinking or wondering about anything 50% of the 5 year olds said this could be done, whilst only 10% of 9 year olds expressed that view (Flavell, 2000).

Flavell's experimental work on development of the awareness of mental activity suggests that experience and practice in reflecting on mental experiences accumulate information, which is used to support conclusions about oneself and others as well as developing insights. Flavell's theoretical model of metacognition provides a framework for analysis of children's behaviour; distinguishes between the various categories of metacognition; is rooted in empirical data with young children and addresses the larger questions of developing consciousness. Metacognition is seen as a necessary development for life rather than an educational tool.

> "In many real-life situations, the monitoring problem is not to determine how well you understand what a message means but to determine how much you ought to believe it or do what it says" (Flavell, 1979) p.910

For these reasons, Flavell's theoretical model informs the work of this project and will be used to analyse classroom data for this project. Whilst a lack of attention to the impact of language development is apparent in this model, this will be addressed by integrating aspects of other theoretical models of metacognitive development as well as specific issues of language development.

2.3 Other models of metacognition

Whilst many models of metacognition are developed as a factor of much larger cognitive models, some theorists have more fully articulated metacognition as a concept. Following Flavell and colleagues' seminal work on metacognition in the 1970s, Nelson and Narens concentrated on the monitoring and control aspects of metacognition. From their work on adult cognition, they described a dynamic model of cognition, which has two levels, called the meta level and the object level. The meta level monitors and controls the object level. It is informed by the object level and in terms of control it subsequently modifies the object level. The object level includes a person's behaviour and the situation in which these behaviours take place. Nelson and Narens acknowledge that self reports are the main tool used to access these processes and these can be imperfect, wrong, biased etc. (Nelson & Narens, 1992). They describe the monitoring process as including ease of learning (EOL), judgement of learning (JOL) and feeling of knowing (FOK). These are all aspects of the meta level of processing and can occur before and during a cognitive task, whilst confidence judgements may occur during and after a task. These introspective judgements are important for both cognitive tasks and social encounters and in both cases they have been found to be less than entirely reliable and accurate. (Nelson, Kruglanski, & Jost, 1998). Thus, from an educational perspective, there is a need to alert students to this possibility and to facilitate more accurate judgements, in areas such as allocation of study time or awareness of stored knowledge.

In contrast to Nelson and Narens' model of metacognition, Wellman's model of metacognition views it as a development of theory of mind. Its origins, he argues, stem from the child's acquisition of the distinction between internal mental phenomena and external material objects and behaviours. Metacognition is not seen as one cognitive item. Its development is a development of a number of interwoven concepts and insights.

> "Acquiring metacognition is thus quite a complex and extended process because it involves acquisition of a multi-faceted theory of mind " (Wellman, 1985b)p.

One of the factors to develop would be the language of mental verbs "think", "believe", "imagine". Wellman's developmental theory sees the development of an understanding of mind as intertwined with the development of an understanding of reality. He doubts that early development of metacognition has much direct bearing on a child's cognitive performance or use of cognitive strategies, but that the development is more salient for understanding the social and physical world. The development of this "multi-faceted theory of mind" is seen as a basis for development of ontological knowledge:

> "metacognition exerts a series of subtle, powerful influences on much of conceptual development"(Wellman, 1985a) p.35

[See Section 4 for further discussion of Wellman's theory and comparison with Kuhn]

Whilst Wellman sees metacognition as part of a larger theory of mind, Cornoldi's model distinguishes between two types of metacognition or what he calls metacognitive reflection. These are a) metacognitive knowledge which consist of a person's beliefs about all aspects of cognition including self evaluation, and this may be generalised or specific knowledge, fully conscious or less so and b) metacognitive conceptualisation of a task. This is metacognition activated by beginning a cognitive task and continues during the task. Cornoldi also identifies metacognitive attitude, which is described as the overall level of metacognitive knowledge and has cognitive, emotional and behavioural implications and specific metacognitive knowledge, which concerns specific aspects of cognitive functioning, (Cornoldi, 1998). It is difficult to see exactly how distinct these latter two aspects are, from the category of metacognitive knowledge described earlier. However, the important aspect of Cornoldi's work for this project, is that it describes metacognitive knowledge as being different from other forms of knowledge, because it includes emotional feelings related to the cognitive task. These feelings may be partly unconscious, but nevertheless impact on cognitive processing and performance.

These fleeting, affective aspects of metacognition have also been studied by social psychologists, in terms of social judgements (Yzerbyt, Dardenne, & Leyens, 1998), social beliefs and prejudice (Banaji & Dasgupta, 1998), and correct impressions (Wegner, Petty, & Dunn, 1998).

As this project is concerned with the development of metacognition in children in an educational setting, it utilises Flavell's developmental perspective on metacognition, whilst incorporating the affective issues delineated in Cornoldi's theory. It also takes account of the importance of the development of a theory of mind and this link is explored in Section 4.

2.4 Metacognition and the necessity of consciousness

The information processing concepts of automatic and controlled processing inform the debate surrounding the extent to which metacognition is a conscious act. Automatic processing has been defined as fast, requiring little effort and control by the subject and operating at a level below consciousness and takes two forms: one that is not age reliant and one which is reliant on experience and repetition, enabling what was once conscious to become automised. (Brown, 1987) In traditional information processing models, which describe a limited capacity system, this automatic processing, making minimal demands on attention resources, is obviously beneficial. As automatic processing is unavailable to consciousness, it cannot be voluntarily controlled or modified. In contrast, consciousness is identified with the employment of attention and rehearsal components, which make more demands on the system, are slower but are essential for higher level processes. Anderson's AEP model of intelligence suggests individual differences in speed of processing. People who process information faster can store more processing and information into working memory and this can be transformed to long term memory and thus consciously retrieved and employed in the future. A slower processing of initial information clogs up the system and information is lost before it ever reaches storage. (Anderson, 1989; Anderson, 1992) If this is how the mind works, then implications for education would be to suggest ways of speeding up and automating basic processing through repetition and experience, whilst providing models of conscious processing by employing novel and difficult problems.

Sternberg's triarchic theory of intelligence, which describes three basic components: metacomponents, performance components and knowledge and acquisition components, also emphasises the role of the high level conscious processing by the metacomponents as necessary for novel and difficult problems. (Sternberg, 1985a) In this model the performance components execute the plans of the metacomponents. The metacomponents monitor and feedback information from the performance components and decide on modifications or new strategies to achieve success. At the same time the metacomponents acquire general information about what works for certain types of problem. This information is processed by knowledge acquisition components and is stored in long term memory, ready for retrieval next time a similar problem is recognised. The metacomponents also monitor and evaluate themselves. A similar notion is taken up by Sanchez in a model of metacognition which involves not only consciousness and control but also a third component "self-poesis".

> "self-poesis – is a component of metacognition as basic
> as consciousness and control: thanks to it, metacognitive

activity is not only conscious of itself, not only controls itself, but goes beyond consciousness and control to construct itself" (Sanchez, 1998)p.30

This model views the intelligent system as a spiral; the self-creating element of metacognition allows the system to add another coil. However, within this system different levels of conscious control are delineated depending on the corresponding function. Consciousness is described as a continuum that runs from "vague functional consciousness" to "reflective penetrating consciousness". However, there is debate about whether the lower end of consciousness, often procedural in nature and seen in displays of error detection and trial and error problem solving even by very young children, can be truly considered conscious. (Brown, 1987; Pressley, Borkowski, & Schneider, 1987)

For nativist theorists (e.g. Fodor) consciousness is not identified with particular functions, all cognitive functions can take place outside of consciousness. Consciousness then becomes a qualitative difference. Whilst the innate cognitive modules controlling such functions as language and visual perception operate outside of conscious awareness, other cognitive procedures which are acquired through experience are initially accessible to consciousness before becoming routinised and unconscious. In this model a great deal of complex cognitive activity can go on outside of conscious awareness, people may reach decisions or conclusions about events unconsciously.

The notion of automated and more conscious processing is also distinguished in Karmiloff-Smith's Representational Redescription (RR) model. Here different levels of processing are described from I level which is procedural and not available to consciousness to more abstract E1 level which, whilst open to inter domain links, is still not conscious, to the higher levels of E2 and E3 which are available to consciousness. Although only at level E3 are the representations both available to consciousness and verbalisable. As Karmiloff-Smith points out, research on metacognition has focussed on this E3 level, as verbal reports have become paramount. However she suggests that E2 representations, whilst not verbalisable, are open to conscious reflection which may be activated through visual reportage, such as diagrams.

> "We often draw diagrams of problems we cannot verbalise. The end result of these various redescriptions is the existence in the mind of multiple representations of similar knowledge at different levels of detail and explicitness"
> (Karmiloff-Smith, 1992)p.22

Interestingly, in the RR model, progression to a more abstract/reflective level of processing is not achieved in the Piagetian sense through disequilibrium but rather from the system reaching a steady state. The view is that as automation occurs, the focus of attention can shift to the internal representations themselves. This Karmiloff-Smith calls "metaprocedural process" and it is obviously a different level of processing to initial goal-oriented processing, but not necessarily conscious or statable.

A variant on information processing models, which resonates with some but not all aspects of the RR model is the PDP (Parallel Distributed Processing) model. (McClelland, Rumelhart, & Group, 1986) Here processing is conceptualised as occurring in a large number of processing units which excite and inhibit others in a network. Information about an object or event is distributed widely across the processing system and it is not necessary for an object to be fully represented in consciousness before information about it can influence experience, thought or action. The main difference between PDP models, and traditional information processing models is that as processing is distributed, there is no need for a higher control function or executive system. Some modules are accessible to consciousness and voluntary control whereas for others, the processing is so rapid across the network as to exceed the span of consciousness. Through fast automatic parallel processing, steady state is rapidly reached and the information becomes accessible to consciousness. PDP models consider all information processing to be initially unconscious, although slowing down the processing by, for instance, ambiguity can provoke conscious awareness. For PDP models then, there is no need for the representation redescription of Karmiloff-Smith's model, or for a central executive function of other information processing models.

For this project the emphasis through children working on CASE@KS1 tasks is to make their unconscious thought processing conscious and verbalisable. As with much research on metacognition, this project relies largely upon self-reports and observable behaviour to categorise the identifiable aspects of metacognitive processing. However, I take the view that whilst the products of this processing are conscious, the processing itself may be rapid, automatic and response driven. One aim of the metacognitive component of the CASE project is to try and slow this processing down so that it becomes available to consciousness and can be shared amongst a group. These issues are returned to in chapter 7. Closely linked to notions of conscious control and monitoring is the notion of self-regulation.

2.5 Self Regulation

Whilst automatic and controlled processing and executive functions arise out of information processing simulations, the notion of self-regulation comes from developmental and constructivist models. For Piaget, self-regulation at its first level of error detection and trial and error theory testing need not be conscious but self-regulation develops through experience, through stages of autonomous, active and finally conscious regulation. It is only when the individual is capable of reflection on an action, that consciousness emerges. This early conscious reflection or "reflective abstraction" is tied to concrete action and is more descriptive than directional. Piaget suggests that it is only with the level of formal operational thought that the individual is fully able to abstract and carry out cognitive processes entirely on the mental plane. This, Piaget sees, as an end state in the development of consciousness. (Piaget & Inhelder, 1969). However, this project takes the view that whilst a consistent and reliable ability to abstract and reflect may only occur with a certain level of cognitive maturity, which may be characterised as formal operational, younger children, given the opportunity and supportive context, may be able to demonstrate this ability in some areas. This forms the lead question which underpins all the other research questions for this project: Can children of five to six years engage in a level of abstraction we can call metacognition?

For other developmentalists self-regulation involves motivation and self-directed action (Zimmerman & Schunk, 1989) or the conscious activities of planning, monitoring and evaluating, thus regulating cognition (Borokowski, Carr, Rellinger, & Pressley, 1990). Occasionally the literature is unclear about the distinction between self-regulation and self-control. However, Diaz clarifies the situation by stating that self-control refers to an internalised model of a real caregiver to whom the child responds, whereas self-regulation involves a self-created and monitored plan of action. (Diaz, Neal, & Amaya-Williams, 1990). The latter self-regulation then seems to be a creative, intentional act driven by consciousness. From this distinction the type of self regulation which is most closely linked to metacognition is the latter, which is generated through either individual introspection or perhaps more likely constructed through social interaction. This socially constructed view forms the basis of the research questions of whether metacognition can be enhanced and the effects of peer group and adult assistance in this development.

Self-regulation is linked to the notion of metacognition as a conscious act. Brown states:

> "the ability to step back and consider one's own thought (or language) as an object of thought and to go further, use the subsequent conceptualisation to direct and redirect one's cognitive theories is late developing. Confused in the metacognitive literature, even lost in some versions of the concept, is the essential distinction between self-regulation during learning and mental experimentation with one's own thoughts" (Brown, 1987)p.96

Brown thus links "true" metacognition to its purpose in directing and controlling learning and makes the case for it being late developing. However, more recently social-cognitive and developmental perspectives have demonstrated aspects of conscious reflection occurring in young children. (Pramling, 1988) [Chapter 7 returns to the empirical evidence for this].

Explanations of self-regulation from social-cognitive perspectives emphasise the developmental changes in cognition responsible for goal setting, attributions and modelling (Bandura, 1986; Schunk, 1989) and self-regulation developing throughout life and constructed by social interactions. (Paris & Byrnes, 1989) The basis for this social interactionist model is Vygotsky, and it focuses on the use of language during social interaction to perform the monitoring and control functions. These functions eventually become internalised. This internalisation is seen as a transformation from the social to the individual level not just an imitation. The transformation is both gradual and mediated by interaction with a more expert other. For Vygotsky all higher psychological functions develop through social interaction. Whilst language plays a central role, the more capable other also aids this inter/intra development by organising and shaping the environment, interpreting events, directing attention and regulating problem-solving. In this way the metacognitive load is lightened for the child; the facilitator assuming the metacognitive functions of regulation until the child can internalise this function. (Vygotsky, 1978) Empirical research has described this theory in action, much of it with mother and child dyads. Wertsch focuses on the development of self regulatory skills in pre-schoolers describing four levels of interaction from basic comprehension of the task to independent self regulation in carrying out the activity (Wertsch, McNamee, McLane, & Budwig, 1980), whilst others have focussed on educational establishments (e.g. (Pramling, 1988)

3 The Link Between Cognition and Metacognition

3.1 Introduction

Following Flavell and Brown's (Brown, 1978; Flavell, 1979) definitional models of metacognition in the 1970's [see previous section], cognitive psychologists turned their attention to the links between cognition and metacognition. They attempted to fine tune the earlier models and to indicate the theoretical, empirical and developmental issues that arise from the concept of metacognition.

3.2 Theoretical Issues

The fundamental issue from a theoretical viewpoint is the extent to which cognition and metacognition are conceptually distinct. Borokowski developing

Campione and Brown's model of intelligence (Campione & Brown, 1978) argues for metacognition as a distinct component; one of the four components of the executive system, along with knowledge base, control processes and scheme. In Borkowski's model the executive system "initiates and regulates retrieval of knowledge from long-term memory, modifies the knowledge base and mediates problem solving"(Borkowski, 1985). Borkowski sees metacognitive knowledge integrated with "strategic behaviours" or control processes as fundamental to successful problem solving and moreover:

> "the dynamic interchange not only enables the learner to select, modify and invent strategies, but also to enlarge the contents of metacognition through successful problem-solving" (Borkowski, 1985) p.114

Whilst arguing for a theoretical distinction between metacognition and the other components of the executive system, Borkowski also acknowledges that in the end this distinction may be false, (Borkowski, 1985).

Other researchers (Brown, Bransford, Ferrara, & Campione, 1983), (Garner & Alexander, 1989; Jacobs & Paris, 1987; Wertsch, 1978) and most notably (Cavanaugh & Perlmutter, 1982) have indicated the difficulty inherent in separating metacognition from cognition. However, whilst Sternberg, (Sternberg, 1986) and Nelson, (Nelson & Narens, 1992) argue for conceptual distinctiveness, it is the empirical work of Slife (Slife, Weiss, & Bell, 1985) and Swanson (Swanson, 1990), which is most often cited as evidence of separateness. The earlier study of Slife, Weiss and Bell measured the effects of metacognitive factors in problem solving, whilst attempting to hold cognitive factors constant among two groups of elementary school students. One group are described as "disabled in mathematics", whilst the other group are described as "regular students", both groups were matched in terms of IQ scores. Whilst the limitations of the experiment are discussed by Slife et al in terms of methodology and adequate matching, their results showed that the "learning disabled" group were less accurate in their knowledge of their own cognition and were less accurate in predicting the number of problems they would solve, even though this group was older and had more practice with the prediction task. The "learning disabled" group were also found to be less accurate in monitoring their problem solving performance and in identifying right and wrong answers. Slife et al argue that since the relevant cognitive factors were matched between groups, it was the metacognitive factors that accounted for their poorer performance and hence cognition and metacognition are distinct factors of intelligence. The argument here, is that cognitive and metacognitive processes are different. Metacognition, as in Flavell's description, involves both stored metacognitive knowledge and monitoring and control functions.

The later study (Swanson, 1990), aimed to determine the independence of metacognition and general aptitude on various problem solving measures. Their sample consisted of children in grades 4 and 5 with diverse academic aptitude as measured by the Cognitive Abilities Test (CAT) (Thorndike & Hagan, 1978) and those with scores below 105 and above 120 were selected. The children were also tested with a questionnaire, designed to test metacognitive aptitude, with those scoring above 45 deemed high aptitude and those below 45 low aptitude. Their results showed that high metacognitive children out performed lower metacognitive children in problem solving regardless of their general aptitude level. Further, the high metacognitive/low general aptitude children performed significantly better than the low metacognitive/ high general aptitude children. Swanson argues that from this evidence, metacognition and general aptitude can be treated as distinct and that metacognitive knowledge has a positive effect on cognition.

Whilst the methods and procedure of these two studies are rigorous and the results valid, the difficulties of measuring metacognitive aptitude are important to note. Thorpe & Satterly, (1990) identified this difficulty further. Testing children on four commonly used metacognitive measures: generating strategies, word list generation, organisation of prose and judging task difficulty, they found a common pattern of development in the children's response, but no evidence for an overall general metacognitive factor. The methodological problems surrounding measurement of metacognition are most pertinent to this project and will be further discussed in Chapter 3.

In addition, Yussen, (1985b) has argued for a more eclectic approach to research on metacognition. He argues that restricting testing of metacognition to problem-solving activities and puzzles such as Tower of Hanoi, used extensively in cognitive research, explores only one rarefied aspect of cognition. In order to gain a better understanding of the influences of metacognitive activity on cognition, a fuller picture is needed, including exploration of ill defined problems and planning activities.

3.3 Further Empirical Evidence for the Effect of Metacognition on Cognition

Difficulties in defining metacognition, as discussed in Section 2, have led to conflicting views on the connections between cognition and metacognition. Working in the area of memory and metamemory, Cavanaugh & Perlmutter, (1982), in a review of twelve empirical studies, found only low to moderate correlation between metamemory and performance on memory tasks, whilst Wellman's similar review, (Wellman, 1983), found substantial links between these two constructs. However it was the work of Schneider, (1985), in comparing these findings that indicates the difficulties in defining metacognition. Schneider pointed out that whilst Cavanaugh and Perlmutter's findings relate to knowledge of organizational strategies, Wellman's review focuses on memory monitoring, and in this sense both findings are correct.

Other researchers have found a positive correlation between metacognition and cognition in terms of memory, (Cornoldi, Gobbo, & Massoni, 1991), bilingulism (Garcia, Jimenez, & Pearson, 1998), problem solving, (Karmiloff-Smith & Inhelder, 1974) (Chi et al., 1980; Chi et al., 1982; Davidson, Deuser, & Sternberg, 1994; Davidson & Sternberg, 1998), reading comprehension (Baker, 1984; Hacker, 1998; Markman, 1979; Palinscar & Brown, 1984), writing (Raphael, Kirschner, & Englert, 1986), maths (Carr & Biddlecomb, 1998; Schoenfeld, 1992), and conceptual change in science (Hennessey, 1999). In addition work with gifted children, which compared the declarative metacognitive knowledge of gifted and non-identified children, of six and seven years of age, through a metacognitive interview questionnaire, found that the gifted children had higher general metacognitive knowledge than other children, (Schwanenflugel, Stevens, & Carr, 1997). Whilst some studies do not find significant differences between gifted and non-gifted children in aspects of metacognition such as meta attention and meta-memory, (Kern, 1989; Kurtz & Weinert, 1989), the majority of studies in this area, has supported the view that gifted children possess greater metacognition than other children. However, Schwanenflugel et al., (1997) indicated an important consideration in this research; the parental support given to gifted children. Moss, (1990), found that mothers of gifted pre-schoolers used more metacognitive comments, when engaged in problem solving with their children, than did other mothers. The effects of social interaction on metacognition will be further discussed in chapter 8.

Whilst many of Schwanenflugel et al's (op.cit.) individual results did not show high significant differences between gifted and non gifted children, closer analysis found that the gifted children understood the reasons and significance of metacognition for performance. For instance, gifted children better understood when it was harder to remember and when it was harder to pay attention. These types of insight, it is argued, are crucial to employing metacognitive knowledge for strategy use. Similarly, Davidson & Sternberg, (1984), found that whilst non-gifted students could be taught metacognitive strategies, which brought their problem-solving performance up to the level of the gifted students, the gifted students would spontaneously search for and select the necessary information. Schwanenflugel et al's research with gifted and non-gifted children supports this claim. The gifted children were more likely to understand the reasons for their metacognitive experiences, for instance, why receiving a list that can be made into a story can help their memory and why it is sometimes hard to attend to something. It is this ability to infer causal and contextual attributions about metacognitive knowledge, they argue, that appears to account for higher usage of metacognition on cognitive problems and further, this ability appears critical to using strategies in unfamiliar situations, (Alexander, Carr, & Schwanenflugel, 1995). Understanding of metacognition then appears to be implicated in transfer of strategies and skills across domains. This is an important aspect of this project since the research questions address not only the facilitation of metacognition but the effect of metacognition on cognitive tasks and achievement across domains.

3.4 Transfer

Transfer may refer to direct crossing over of a skill from one domain to another or the construction of a new skill, which involves a new combination of old skills and knowledge. The ability to transfer skills from one domain to another is crucial to learning. Brown et al, (1983), have argued strongly that the ability to transfer skill from a context dependent state to a relatively context independent state, marks an important stage of development in learning. Citing empirical studies as evidence Davidson & Sternberg, (1998), have described the variables that are relevant to successful transfer. These are cognitive ability, similarity of the structure of different problems, similarity of content, practice and experience with similar solution problems. The metacognitive aspects of strategy knowledge, including knowing when and how to use them are especially important in successful transfer. Work with expert problem solvers found that experts are more attendant to the deep structure of the problem they are solving and use this knowledge to select a particular strategy, whilst novices are more likely to attend to surface structure or content similarity, (Chi et al., 1980). In addition, skilled problem solvers use metacognitive processes to monitor and modify their image of the problem as they seek to solve it, (Hayes, 1981).

The ability to transfer, as displayed by expert problem solvers, appears to depend on the ability to abstract principles of the problem, which allows for a mental representation that is not context bound or tied to the concrete aspects of the problem. Carr & Biddlecomb, (1998), have suggested that children's inability to transfer mathematical knowledge to real-life situations is a result of their inability to abstract at a more general level. They compare this high level abstraction, which involves self-awareness and which allows for reflection on the process and results of reflection, to the Piagetian notion of "reflected abstraction" (Piaget, 1976). This is contrasted with other forms of abstraction: empirical which is based on sensory/motor material and reflective, which uses schemes and mental operations as source material. It appears that it is this higher level, reflected abstraction, which allows for the gifted children in Schwanenflugel's (op.cit.)work to infer causal and contextual elements of their metacognition. Carr & Biddlecomb, (1998), suggest that without a general level of abstraction, children are unable to see the relationships among different types of maths problems and consequently, cannot see beyond the task in hand. Implicit in this notion of reflected abstraction affecting transfer, is the view that the abstraction is a conscious, verbalisable process. However, another view delineated by Adey & Shayer, (1994), suggests that the highest level of abstraction may result from an unconscious development of a central processor in the brain effected through practice with the Piagetian notions of cognitive conflict and construction. These factors, they argue, are at least as important as metacognition, in producing transfer. Most of the programmes, which have sought to improve problem-solving ability across domains, have used instruction in metacognitive processes and moreover, have found that talking about strategies, and explaining reasoning with peers and others has a positive result, (Palinscar & Brown, 1984; Paris, Cross, & Lipson, 1984; Resnick, 1988). The reciprocal learning process used in reading by Palinscar and Brown led to marked improvement in reading comprehension, which lasted over time and across domains.

Many early thinking skills programmes found that their methods of teaching general, logical thinking skills, in order to solve puzzles, did not enable students to transfer these thinking skills to achieve better results, in different academic subjects. Similarly, when thinking skills have been taught in one particular curriculum area, they often do not transfer to other curriculum areas, (Nickerson, Perkins, & Smith, 1985). However, in this respect a precursor to the CASE@KS1 project, CASE@KS3, which involved secondary school children replacing their science lessons with CASE@KS3 lessons, did find that children on the programme attained better results in science, mathematics and English, when compared to the control groups, (Adey & Shayer, 1994). It may be that these secondary school CASE tasks enabled the students to explore and play with their thinking processes, and this flexibility of thinking transferred across domains, affecting attainment in different subject areas. As Claxton has pointed out, learning strategies are tied to the context in which they are learned. It, therefore, seems necessary to provide a variety of contexts and guises in which these strategies can be used. The learner should then be encouraged to make links between these contexts and transfer their thinking processes. It is this process of repeated embedding, disembedding and re-embedding of thinking processes and contexts that makes transfer of learning more likely. (Claxton, 1999)

Similarly, Carr, (Carr & Biddlecomb, 1998) argued that whilst abstraction needs to be encouraged, care should also be taken to facilitate development of children's cognitive structures and to provide for a strong conceptual knowledge base, from which children can construct strategies and metacognitive awareness of those strategies. This echoes Brown's caveat to facilitating metacognition, that it is impossible to reflect, unless there is something to reflect about (Brown, 1987), and supports the growing consensus that metacognitive strategies should be taught within a domain, rather than independently.

4 The Link between Theory of Mind and Metacognition

4.1 Introduction

The theory of mind literature has tended to focus on the child's developing ability to attend to her own and others' mental states and to connect mental states to behaviour. However, in debating how this ability develops, the literature suggests links between theory of mind and metacognitive processing, and yet the development of each appears to follow different paths.

On one level, the development of a theory of mind involves becoming self-conscious and conscious of others. It involves thinking about representations: desires, beliefs and intentions, rather than about objects. Thus it involves a development of meta-representations (Olson, Astington, & Harris, 1988a).

One of the main differences between theory of mind and metacognition is that under "normal" conditions the child develops a theory of mind simply and seemingly without overt instruction; so that by the age of four children are almost always successful at passing standard false-belief tests. [Evidence from (Wimmer

& Perner, 1983) and this project chapter 6]. Under three years old, the majority of children fail these same tests. Carpendale and Chandler argued that what has developed by the age of four is a "copy theory of mind" in which children mentally represent behaviour in the world in a straight forward copying sense. They argue that this is only the beginning of developing a theory of mind and not until much later (i.e. middle childhood or beyond), do children consciously construct representations and become aware of doing so. That is they develop an interpretative theory of mind, which enables them to comprehend that given the same stimulus two people can have different interpretations and that both are valid, (Carpendale & Chandler, 1996). They argue that the problem with the standard false belief tests, such as Maxi and the chocolate or the Smartie tube test, is that when children answer these correctly, researchers draw the conclusion that they are aware of the "interpretative nature of the knowing process" (Carpendale & Chandler, 1996) p.1687. They say that passing such tests requires only a basic understanding, that people with different experiences, end up with different beliefs. Their argument is also borne out by the post-tests done with five to six year olds for this project, (See Chapter 6). This awareness of the self-constructive nature of thought, is more truly a metacognition than the process involved in "copy theory of mind".

4.2 Theory theory model

The main debate regarding the development of theory of mind centres around two competing paradigms: The theory theory notion (Gopnik, 1996; Gopnik &

Wellman, 1992; Wellman, 1990) and the Information Processing idea best characterised by TOMM, (German & Leslie, 2000). The theory theory notion views the child as a scientist trying to make sense of their world. In this view the child builds concepts of the world through interaction with the environment and assimilates these concepts into a theory. As the theory is tested and found to be wanting, for example, in the experience that what people say does not always equate with their behaviour, then the theory is replaced with a more adequate one. This does not imply however, that the child is consciously aware of this process, or that s/he is evaluating evidence in order to change the theory as a scientist might. In this sense then the theory theory approach is not commensurate with a meta-process. Perner made just this distinction in his theory theory model, which refers to a concept termed prelief, (Perner, 1995; Perner, Baker, & Hutton, 1994).

The concept of prelief states that whilst three year olds understand pretend play, can relate an agent to a proposition (e.g. a mother using a banana as a telephone), and can evaluate this situation as pretend, the three year old does not understand that the agent also relates to and evaluates the situation and that evaluation may be different. Yet, by the age of four, children have come to this understanding. The distinction is between what something represents and how it represents it. Only if there is a conscious knowledge that this distinction exists can we call this a meta-level process.

The theory theory approach of Gopnick and Wellman (op.cit.) suggests a development of theory of mind between the ages of two and five. The two year old is driven by desire towards objects, but there is no propositional relationship between the mental state and the world. The three year old has developed a theory that encompasses belief and that makes the link between thought and behaviour. By the age of four to five, the child has mastered the concept of misrepresentations. For the theory theorists, the process of the child's changing concepts in developing a theory of mind are no different to the processes of conceptual change in any other domain, for example, number, science and the natural world. Carey suggests that important factors for conceptual change in these other domains are metacognitive, for example, the use of analogy, comprehension monitoring and abstract comparisons, (Carey, 1985; Carey, 1988).

Wellman suggests that children build a theory of mind in this conceptual way from their own experience and observations and comparisons with others' experiences. Whilst this is a domain specific theory building, once it has developed, it becomes part of other concepts, (Wellman, 1990). In Wellman's sense the initial theory of mind must become integrated with the larger concepts of cognition to become of practical use in understanding the social and personal world. When he refers to theory of mind, he speaks of the whole developmental conceptual theory of inner states: knowledge of oneself as a cognitive being and knowledge of others as cognitive beings is one aspect of his model. The model fully consists of:

1. Existence: knowledge that mental processes exist and that "people possess minds"

2. Distinct processes: distinguishing of mental processes e.g. dream, think, reason

3. Variables: mental and non mental processes that impinge on persons mental states

4. Integration: relatedness of mental processes, how they co-ordinate and compete

5. Cognitive monitoring: assessing state of own cognition and "knowing how" to apply cognitive conceptions to tasks

Edited from Wellman, (1985a)

In this way then, Wellman's view is of an integrated theory of mind or a development of metacognition.

From empirical research Wellman credits the pre-school child with a naïve understanding of at least the first four of the above categories. Much of the empirical evidence on which this model relies involves experiments where children are asked questions about mental states. In these tests, children as young as two can use mentalistic words such as "think", "believe" and "remember". However, Mitchell suggests that use of these words does not definitively refer to descriptions of mental states. In addition, these mental states that the words seek to describe are not consistent and use of a descriptive word does not mean that we are describing the same thing. Furthermore, references to another's mental state demands we make an analogous connection between what we feel and what the other appears to feel, from our observation of its behaviour and language, (Mitchell, 2000). It is perhaps, as Olson suggests, that use of mental state terms in fact, describes the perspective of the speaker, (Olson, 1988b).

Mitchell goes on to argue that it is this very ability to attend to one's own mental state that allows us to describe another's. The idea is that since an understanding of the self as having mental experiences implies the concept of a person, we therefore understand that there are others (persons) like ourselves. It is only when the child distinguishes self from others, that s/he becomes aware of mental states. In contrast to the theory theory model, Mitchell suggests that rather than extrapolating from one's own experience to understand another's mental state, the understanding only comes about through an understanding of cultural norms. The suggestion is that the story we tell ourselves about others' mental states has to make sense to us in cultural terms:

> "differences between children and adults in their psychological interpretations may well be based on differences in interpretations of what is plausible given a story" (Mitchell, 2000) p.51

In this view the development of theory of mind involves the development of increasingly sophisticated analogies, which are used to connect the self to others and the environment. This use of analogy is a meta-process. Thus rather than theory of mind developing spontaneously through interaction with the environment, it is encultured by the covert forces of the social/cultural world. It is more common for children and adults to speak of their own or others' beliefs and desires, than for them to reflect metacognitively on a problem. It may be, that understanding of self and others is more salient, than understanding of the concepts of cognition, or that, as Yussen suggests, understanding of self and others is in constant flux and therefore defies absolute categorisation, (Yussen, 1985a).

If this is the case, then Langer's suggestion that a child's state is one of "mindfulness", whilst increasing age tends, through routinised behaviour, to lead to "mindlessness", then the child is constantly interpreting mental states, which allows for rapid development of theory of mind. In contrast, for the adult the only reason to become metacognitive about a situation is when the structure of the situation is novel. The importance here, is the distinction between the novelty of structure, which leads to mindfulness, against the novelty of content, which does not, (Langer, 1985). It is, however, difficult, as Yussen has argued, to interpret these states of "mindfulness" and "mindlessness". Yussen's critique of Langer's position suggests that even a mindless state involves some processing, and although behaviour may suggest mindlessness, we cannot be sure that is the individual's state, (Yussen, 1985a).

4.3 Cognitive Complexity and Control Theory (CCC)

So whilst Mitchell has argued against the theory theory approach from the point of view of social/cultural narratives and Langer has argued against its developmental perspective, Frye's contention with the theory theory approach is that it is domain specific. Frye points out that theory of mind is different from beliefs about nature, since theory of mind is not identified by content. Instead, it rests on "making connections between mental states and content", (Frye, 2000). This making of connections appears to be a meta-level process. Frye's model of Cognitive Complexity and Control Theory (CCC) states that the developmental changes in theory of mind are due to the ability to reflect upon judgements made. He suggests that it is the ability to employ "embedded rules" i.e. "if-if-then" rules rather than "if-then" rules. This seems to resonate with Flavell's descriptions of level 1 and level 2 processing, (Flavell, 1978). The development of theory of mind is then seen as a development of a meta-representational system, in which executive functions of planning and deliberative action are necessary. Frye also suggests that development of theory of mind is not just a change in conceptual theory (as in the theory theory model), but a change in the child's psychological capabilities.

Similarly, the Information Processing model of German and Leslie also finds the theory theory model wanting, since there is no demand for the possession of abstract concepts to depend on knowledge of those concepts. They argue that it would seem impossible to build a theory without knowledge of the concepts one is employing and that the theory theory model does not explain how the child develops a theory of mind, except in an analogous description of other concept development. Their own theory seeks to fill this gap and postulates a Theory of Mind Mechanism (TOMM) in the brain, which is specialised for attending to mental states,(German & Leslie, 2000).

4.4 Theory of Mind Mechanism (TOMM)

The TOMM model describes attitude concepts such as belief, desire and pretend as featuring in representational structures called M-representations (meta-representations). These M-representations are distinct, in that they specify an agent, a content and an anchor to the real world. The TOMM does not provide the child with a theory of pretending or believing, but a basis for acquiring knowledge about mental states. By attending to mental states, the child learns about them. Thus, in the TOMM view, the child recognises pretence, without knowing what pretence is. Central to the information processing model is the notion of a selection processor (SP), which develops over the early years and allows the early default mechanism of seeing beliefs as true, to be overridden. A false belief experiment by Zaitchik showed that children who do not get to see, but rather are told that an object has changed place, outperform the children who are given a standard task, (Zaitchik, 1991). German and Leslie put this success down to the inhibitory factor of the SP being lessened because, without seeing something, the child is not sure what the truth is and therefore does not need to override the "default true" mechanism in the same way.

Whilst German and Leslie's evidence against a theory theory model of theory of mind is compelling and their model of TOMM and the SP makes sense given the correlation between developmental tests and standard false belief tests, it is hard to find any evidence for such a mechanism in the brain from neuropsychology.

Although work by Umilta and Stablum, (1998),in neuropsychology has shown evidence for control mechanisms that can selectively impair cognitive processes and these control mechanisms depend on the activity of the frontal and pre-frontal areas of the cerebral cortex. Their work does not use theory of mind tests but more general attention and cognitive tests. There is some evidence that links certain areas of the brain (mainly Brodmann areas 8&9) with theory of mind tasks and this region is also known to be involved in executive control, (Fletcher et al., 1995; Passingham, 1993) However, Perner, (2000), has suggested problems with this linkage. Firstly, the evidence is not age or task specific and secondly, environmental factors, which make a difference to mastery on false belief tasks, do not correlate with brain maturation. Perner suggests that further research needs to be done on the environmental factors, such as number of siblings and on the delayed mastery of false belief in deaf children and blind children, (de-Villiers & de-Villiers, 2000; Minter, Hobson, & Bishop, 1998).

Whilst both the theory theory model and the TOMM model give convincing accounts of how theory of mind develops, the important question of why it develops, seemingly without overt instruction and the role of language and social enculturation, are skated over in both models.

4.5 Development of theory of mind in a larger context

If we view a developing theory of mind as a life-long enterprise, evidenced by the fact that adults often return to a naïve realism, then the importance of communication and enculturation become more prominent. Fabricus and Imbens-Bailey conclude that representational reasoning is not acquired suddenly, but involves prolonged learning. Understanding how representations work must come from interpretations of people's actions and speech in context, (Fabricius & Imbens-Bailey, 2000).

For Freeman, the mastering of "notational systems", (for example, drawing, sculpting, writing, number symbols etc.), allows for a diversification of mentalistic reasoning, (Freeman, 2000). The argument is, that the reasoning we develop about agents, is naturally connected to reasoning about the physical objects that the agents produce, in order to communicate. We learn about both together. Freeman's argument, based upon one representational system, visual art, employs the notion of "intentional dispersion" as being a central topic of theory of mind.

"Intentional dispersion" relates to the simultaneous (effects/intentions) provided by one representational and communicative artefact. Thus Freeman explains, a picture of Charles I as Caesar may be a portrait of Charles, be about the artist's conception of kingship and be directed towards viewers with an intention to influence their perception. In a similar way, we look for intentional diversity in what people say and do. Events where the agent intends some thing more or other than what is immediate, make us reflect on communication and the devices agents use, as well as on mental states. It seems that the experience of complex communicative interactions facilitates the development of theory of mind. These communications may be language based, or emanate from other complex sign systems.

The importance of language competence for developing theory of mind has been shown by work with deaf children, (de-Villiers & de-Villiers, 2000). Their argument is that the development of certain grammatical rules necessary for language competence also govern the development of the internal language of thought, without which, it would be impossible to think about someone's mental states. Their work has suggested that the ability to deal with complements, precedes, and is seemingly a pre-requisite for, understanding false belief. They describe a development of language from the basic sentence mapped onto an event which is true, through the ability to understand the discrepancy between sentences and reality (as in pretence), to mastery of embedded structures and realisation of falsehood in embedded structures (as in lies, mistakes). Then there is an extension from verbs of communication to verbs of mental states (as in beliefs), which enables the child to represent the invisible thoughts and beliefs of others.
They do not claim that theory of mind depends on language, but that the specifics of the false belief test, depend on a certain mastery of language. They view the overall process as one of mutual facilitation between language and theory of mind and point out that conceptual development in theory of mind may also facilitate later language development. Language development and verbal fluency are recurring themes throughout this project. See chapter 6 for further discussion of language and metacogniton.

Counterfactual reasoning is also seen to be important in success on false-belief. Perner and Feichtinger's ongoing research quoted in (Perner, 2000) on counterfactual reasoning, found that reasoning from a complete counterfactual conditional was more difficult for three to five year olds than reasoning from counterfactual antecedents or future hypotheticals. Robinson and Beck also suggested that false belief and counterfactual tasks are mastered at the same time, since both require an understanding that the same proposition can have different truth values, (Robinson & Beck, 2000). For Perner the mastery of the counterfactual depends upon an understanding of "aboutness", and understanding that counterfactuals are about the real world but are false. The counterfactual conditional takes reference points from the real world. It is different to an understanding of pretence, but shows events as being different from what they really are. For Perner then

> "to think this way requires the same intellectual ability
> that I have claimed necessary for false belief: to
> understand a proposition(the context of the belief;
> the counterfactual conditional) as referring to (be about)
> the real world"
> (Perner, 2000) p.394

Perner goes on to distance himself from the strong theory theory approach by finding salience in the simulation theory of Riggs and Peterson (Riggs & Peterson, 2000), which equates mastery of false belief with a general ability to "imaginatively reason". Riggs and Peterson argue that rather than success on false belief tasks being dependent on having acquired an understanding of meta-representations construed as a theory, (as in theory theory) what develops is an ability to construct an answer to a false belief question. They argue that beliefs are not held in the mind in a finished form, but that a question triggers an imaginative construction of the event in question and this leads to an answer. The incorrect answer is then a failure in reasoning, rather than a failure to understand the concept of belief. They make the point that the reasoning employed is "everyday, practical reasoning" and not deductive reasoning. The answers are probable and not certain. Their empirical work suggests that the difficulty children find with false belief tasks lies in the counterfactual reasoning required. The importance is on being able to simulate the self in a past state and to suppress information we know now. Thus ascribing false belief to others is the same as ascribing false belief to oneself and the mental state is not directly simulated rather "it is the knowledge base that we simulate directly, while the belief is derived" (Riggs & Peterson, 2000) p.96.

This model counters other models of theory of mind that suggest that children first have knowledge of their own mental states and then apply these concepts to others through analogy. This would seem to suggest a less important role for executive functions, although Riggs and Peterson are careful not to entirely rule out the role of executive functioning as an explanation for why children fail counter-factual reasoning tasks.

4.6 Theory of mind and development of epistemology

An important link between theory of mind and metacognition in the context of lifelong development of reflective thinking is made by Kuhn, (Kuhn, 1999; Kuhn, 2000). Kuhn argues that the challenges children face in understanding a theory of mind are connected to the more complex forms of thinking that challenge adults' effective reasoning. More specifically, the link Kuhn makes is between meta-knowing, meta-strategic knowledge and epistemology. Meta-knowing is defined as awareness, understanding and control of one's own cognitive functions and those of others (knowing that), whilst meta-strategic knowing is about mental processes (knowing how) and epistemology the conceptualisation of knowing in its abstract, theory form. The argument is, that a truly constructivist theory of mind recognises this epistemological concept and ultimately maintains what she terms an "evaluative epistemology".

> "Evaluative epistemologists have reconciled the idea that people have a right to their views with the understanding that some views can nonetheless be more right than others. They see the weighing of alternative claims in a process of reasoned debate as the path to informed opinion, and they understand that arguments can be evaluated and compared based on their merit."
> (Kuhn, 1991) cited in (Kuhn, 2000) p.318

As with Piaget's formal operational thought and the idea of "reflected abstraction" (Piaget, 1976), the notion of evaluative epistemology could not be considered until adolescence at the earliest and may never be achieved at all.

Kuhn's lifelong perspective seems to answer the difficult questions of when, how and why metacognition and theory of mind develops. Whilst not a theory theory approach it has resonance with the developmental perspective of that movement, but it also resonates with Langer's theories of "mindfulness" and "mindlessness" (Langer, 1985) and with the growing complexity of the various processing mechanisms in the brain, which develop over time, as described in the information processing movement. If Kuhn's conceptual change theory is correct, then it argues for educational practice to take this into account, throughout the school years and beyond. It is then better to start early with facilitating metacognitive processing in the early years of schooling and building upon this groundwork in the years that follow. Likewise, theory of mind doesn't stop with an understanding of others as cognitive beings but needs continuous stimulation to continue to develop.

> "Young children's dawning awareness of their own and others' mental functions lie at one end of a developmental progression that eventuates in complex meta-knowing capabilities not realised before adulthood, if they are realised at all" (Kuhn, 2000) p.320

Kuhn also argues that meta-knowing is strongly implicated in cognitive ability and knowing how you know, puts oneself in charge of knowing and ultimately in charge of one's own life.

Kuhn's emphasis on the acquisition of an evaluative epistemology in which it is recognised that an individual has their own perceptions of an event, whether correct or not, seems to form a link with the phenomenology of the French philosopher M. Merleau-Ponty. Merleau-Ponty argues against both empiricism and rationalism to formulate a phenomenology that understands that human behaviour is always open to conscious interpretation. What needs to be evaluated and debated then, is not only the perceived behaviour and context of that behaviour, but also the pre-conceptions of the perceiving subject. Rather than perception being one of pure sensations, human beings are always presented with interpreted objects. Understanding this and using this understanding to evaluate our own and others' behaviour seems to be the ultimate goal of metacognition and theory of mind. Trying to understand one's own and others' behaviour in the world, appears to be part of the human condition and an activity in which we all engage at whatever level. For Merleau-Ponty, in order to understand the world we have to not only study the world, but also ourselves (Merleau-Ponty, 1962).

5 Recent Literature

Following Flavell's seminal paper on metacognition and cognitive monitoring (Flavell, 1979), there was, throughout the 1980s and 90s a deluge of research papers published which allied metacognitive processing to cognitive skill and academic performance. (Alexander et al., 1995; Borkowski, 1985; Borkowski, Ryan, Kurtz, & Reid, 1983; Carr, Alexander, & Folds-Bennett, 1994; Davidson et al., 1994; Forrest-Pressley & Waller, 1984; Garcia et al., 1998; Hall, Bowman, & Myers, 1999; Hennessey, 1999; Jacobs & Paris, 1987; Kern, 1989; Kurtz & Weinert, 1989; Lucangeli, Galderisi, & Cornoldi, 1994; Luke, 1999; Pramling, 1988; Pressley et al., 1987; Raphael et al., 1986; Schoenfeld, 1992; Schwanenflugel et al., 1997; Slife et al., 1985; Sternberg, 1998; Swanson, 1990; Zimmerman & Schunk, 1989). From a developmental perspective metacognition quickly became associated with abstract levels of thinking, particularly in a Piagetian sense it was linked with "reflected abstraction" (Piaget, 1976). In this sense, metacognition became a developmental goal.

In recent years there has been a growth in research into the development of metacognition in children. As Whitebread points out, the early research into children's metacognition, which tended towards laboratory based studies emphasised what children could not do, (Whitebread, Coltman, Anderson, Mehta, & Pasternak, 2005). However, more naturalistic studies such as those by Whitebread in nursery classrooms [ibid]; by Georghiades and Thomas in primary classrooms, (Georghiades, 2004; Thomas, 2003) and evidence from this project, in primary classrooms, have shown that the early laboratory based studies may have under-estimated the metacognitive abilities of young children. Importantly, these most recent studies have used different methodologies in order to investigate metacognition in education. Instead of relying on self-report and laboratory studies, these new studies have used observations of children's behaviour in naturalistic settings or have asked children to comment on their own or others' cognitive behaviour whilst engaged on cognitive tasks. Whitebread in particular, claims that these methods provide much more reliable indications of children's metacognitive processing. His team have collected evidence from 32 early years classes of children of 3 to 5 years, demonstrating children's metacognitive abilities in terms of metacognitive knowledge and self regulation of performance, [op.cit].

However, as research for this project shows investigating children's metacognition in classroom settings is not without its particular problems. In particular, educational practices that are likely to encourage metacognitive development and the practice of metacognitive language are not commonly observed elements within early years settings, as a number of researchers have pointed out, (Bartsch, Horvath, & Estes, 2003; Fisher, 2002; Thomas, 2002a; Thomas, 2003; Whitebread et al., 2005). Whilst this lack of educational practices likely to facilitate metacognition is a consistent finding from UK classrooms following the national curriculum, there has been, to date, a large number of intervention programmes designed to remedy this situation. These have included many different types of thinking skills programmes and interventions, (See McGuinness, 1999; and Eppi Centre Review, 2004, for an overview).

However, many projects based in educational contexts naturally prioritise the educational achievement aspects of metacognition and tend to grapple less with the theoretical issues surrounding metacognition. There is a danger that metacognition is becoming seen as a cure-all for underachieving students and in the process, there is an over simplification of definition or a confusion of terms such as metacognitive skill, metacognitive awareness, meta-reasoning, metacognitive ability, meta-learning and so on. It is important that the empirical evidence from recent research projects in naturalistic settings is used to develop theory of metacognition, as well as offer pedagogic strategies, [See chapter 10 p 432].

The theoretical distinctions of different aspects of metacognition made during the 1990s have developed Flavell and Brown's original conception of metacognition and led to distinct theoretical fields. The metamemory research strand continues with the work of Nelson and Narens, who delineated two different types of metacognitive processing: self-monitoring and self- regulation (Nelson et al., 1998; Nelson & Narens, 1992). The self monitoring aspect refers to keeping track of one's own cognitive progress during a task and this is seen as a "bottom up" process as information from the interaction between the self and the task is fed back. Self regulation, on the other hand, refers to the executive activities of planning, directing and evaluating and is seen as a "top down" process. The study of self-monitoring focuses on ongoing feelings and judgements such as ease of learning (EOL), judgements of learning (JOL) and feeling of knowing (FOK). It is from studies of children's monitoring processes that theories of self-regulated learning have developed. This continues to be an important link between metacognition theory and educational practice. The concept of self-regulated learning has been developed to include an understanding of the learner's personal goals as well as the contextual features of the learning environment. Boekaerts suggests that learners need to develop and aptitude for both social regulation and self regulated learning. She goes on to say that students need to practice and extend their goal setting processes in order to flourish and take control of their own learning,(Boekaerts, 2002).

Whilst Boekharts uses the concept of self-regulated learning to bridge the gap between psychological theories of learning and classroom practices, Kuhn provides a similar bridge between theory and practice in terms of metacognition. Kuhn uses her theoretical conceptualisation of metacognition and theory of mind (see section 4.6) and links this with the educational concept of critical thinking, proposing that teachers need to understand the theoretical concept of metacognition and how best to foster it, (Kuhn & Dean, 2004).

In a similar way this project aims to make the connection between the original broad conception of metacognition as delineated by Flavell (op cit) and the educational practices observed in year one classrooms during a cognitive acceleration programme, and during the normal numeracy curriculum. The reasons for using Flavell's theory rather than any other have been outlined on page 35. However, whilst Flavell's theory is used as a framework for coding the observable metacognitive behaviour of the children in the study, the coding of teacher behaviours, which appear to affect or facilitate this processing uses a grounded approach. By using this double approach the social, contextual and psychological factors of later theories of metacognition can be taken into account.

Whilst this project explores metacognition in terms of education and learning research on metacognition has widened to other areas outside of education, such as emotional disorders and psychotherapy (Wells, 2000), forensic psychology and eye witness accounts (Perfect, 2002), substance abuse (Toneatto, 1999). Since the early days of research on metacognition in the 1970s it has been closely linked to work on memory and this strand of research continues along with neuropsychological and neuropsychiatric research such as (Hanten, Levin, & Song, 1999; Rourke, Halman, & Bassel, 1999). Work on the neuropsychological aspects of cognition and metacognition have led in the past to major advances in the building of theoretical models of metacognition and theory of mind such as the representational redescription model. (Karmiloff-Smith, 1992).

Metacognition continues to be linked to motivation and other aspects of the self and personality (Boekaerts, 1999; Vollmeyer, 1999). There has also been a major input in these areas by researchers from a social psychology perspective. This movement perhaps began with a special issue of the journal Personality and Social Psychology, dedicated to metacognition (1998), in which Jost, Kruglanski and Nelson discuss metacognition in terms of its situated cultural and social context (Jost, Kruglanski, & Nelson, 1998). This important article has led to a growth in research from this perspective and in terms of education, work by Thomas, (2000; 2003) has gone further to show not only how metacognition is socially situated but how it can be socially constructed through classroom discourse.

In recent years psychologists and educationalists have come together at conferences such as European Association for Research on Learning and Instruction (EARLI) in 2003 to set up special interest groups in metacognition and there is now a new journal dedicated to research on metacognition and learning, (Veenman, 2005).
However, whilst research on metacognition expands into applied areas and to take account of social contexts, there are still sceptical voices, which suggest that metacognition may not be as separable from cognition as researchers believe. It may be no more than a difference in intention, rather than a qualitative difference in cognitive processing, (Brown, 2003).

Whilst this project takes Flavell's developmental view of metacognition as its base, the problematic issues of observing and describing others' metacognitive behaviour are addressed. In addition, following the research from social psychology, the influence of social and contextual factors are also explored. Moreover, in recent years there has been a growing awareness amongst some psychologists of the need to bring together research on cognition, with description of what those cognitions mean and feel like for the individuals experiencing them. Thus there is now a society for phenomenology and cognition and a related journal, along with a new journal of qualitative research in psychology, which includes phenomenological approaches. This study takes the understanding of what it means to be metacognitive as an underpinning research theme and uses phenomenological description to seek an understanding of what metacognition is for five to six year old children, (see chapters 5 and 6).

6 CONCLUSION

This chapter has discussed various models of metacognition. A choice has been made as to which to include and which to leave out. The choice was informed by the extent to which a given model can be seen as an example of a particular movement, in developing theories of intelligence and the importance given to metacognition in the larger model. The links between cognition and metacognition have been discussed, with emphasis on data supporting conclusions, as this informs the analysis of data for this project. Section 4 concentrated on the development of theory of mind, because this is acknowledged as central to the development of metacognition, indeed for Wellman, metacognition is one aspect of his categorisation of theory of mind. For this project, working with young children, 5 and 6 years old, it is hypothesised that theory of mind will be in the process of developing sophistication and will be used as a measurement (along with others), of a general metacognitive ability. This will be taken up in chapter 3 and chapter 6 where the difficulties of measuring metacognition will be discussed.

Three major themes appear to have arisen out of this discussion of the theoretical underpinnings of metacognition. One is the development of consciousness and the role consciousness plays in cognitive tasks. This theme will be returned to throughout this thesis. In order to understand and describe more carefully what was observed, different approaches will be taken. One way to address the notion of consciousness and to find a middle ground between a psychological behaviourism and introspection may be to take a phenomenological approach to the question and the analysis of data. This will be explored in chapters 5, and 6.

The second major theme arising from the above and informing this project, is the development of language. Working with young children, some of whom are communicating in a language which is not their first language, brings obvious problems of analysis. In addition, the extent to which metacognition must be verbalised is a theoretical problem which will be further discussed in chapter 3, along with the difficulties surrounding non verbal communication.

The third is the situated nature of metacognition and the role of peers and adults in its facilitation. Recent research shows a trend towards applied metacognition and the importance of metacognition over a larger number of domains and throughout the life-span. In the light of this, the lead research questions for this project which are:

1. Can metacognitive ability be enhanced?
2. Are metacognitive gains related to cognitive/academic gains?
3. How is metacognition facilitated in year one classrooms?
4. What factors associated with teachers impact on the development of metacognition in year one classrooms?

are broken down into further sub questions, which address these major themes.

This project aims to investigate the notion of whether five to six year old children are capable of metacognitive processing and the variables that interact to affect its development. As this project is set in an educational setting the study aims to provide practical suggestions for educators, as well as investigating and describing metacognition in situ. The next two chapters discuss the research questions in more detail and show the progression of this project from an early pilot study to the final research design.

Chapter 3

PROJECT DESIGN AND METHODS

1 INTRODUCTION

The review of the literature on metacognition in the previous chapter suggested that whilst there remains a view that metacognition when defined as fully conscious abstract reflection on cognition is late developing, a number of researchers have shown evidence of young children displaying metacognitive processing in some areas. (Alexander et al., 1995; Bartsch & Wellman, 1995; Boekaerts, 1999; Borkowski & Peck, 1986; DeLoache, Cassidy, & Brown, 1985; Estes, 1998; Estes, Wellman, & Woolley, 1989; Flavell, 2000; Flavell, Green, & Flavell, 1995; Kontos, 1983; Kreutzer, Leonard, & Flavell, 1975; Markman, 1979; Pramling, 1988; Schwanenflugel et al., 1997; Thorpe & Satterly, 1990; Wertsch, 1978). It is clear that from the age of four, children have developed some form of theory of mind and are able to consider themselves and others as cognitive beings. As this project is set within an educational context, it is important to investigate not only the extent to which children of five to six years old are capable of metacognition but also to explore the social and contextual variables that may impact on its development.

This research project is embedded within the larger context of the CASE@KS1 intervention project and as such, it involves some of the same population of schools and children engaged in the main project.

Firstly, this chapter describes the geographical and demographic characteristics of the area of London, in which, the research took place. Then the particular characteristics of each of the seven schools involved are described. These data are taken from local education authority sources, whereas in later chapters, research field notes are used, to describe some details of the year one classrooms.

Secondly, the four main research questions are described and broken down into more specific sub questions. Three major factors of the investigation are then discussed. These are: the problem of how to measure metacognition; the possible effects of verbal ability on metacognition and the ethical issues surrounding research with children.

2 DEMOGRAPHIC DATA

2.1 The Area

The inner London Borough, which is home to the schools involved in this project, is one of the smallest of the 33 London Boroughs, both in geographical area and population, but it has one of the highest population densities. It contains some of the most affluent areas in the country and some of the most deprived.

Unemployment ranges from 16% in some wards to little more than 3% in others. The population is also ethnically diverse. Over eighty languages are used in the borough and over 12% of homes use additional languages to English. (Source local authority guide). The borough has a wide range of schools including, Voluntary Aided, County schools and Special schools. Most primary schools in the borough have nursery classes, which provide places for three and four year olds. Children enter main school reception classes in the year in which they become five. Year One children are therefore between five and six years old. There may be a gap of nearly a year however, between the youngest and oldest in any one class.

2.2 The Schools

The schools for the main CASE@KS1 project were recruited by negotiation between the project director and the local education authority. Of the ten CASE@KS1 project experimental schools, four were recruited to participate as experimental schools for this research. These schools are here labelled A,B,C and

D. Similarly, from the five CASE@KS1 control schools, three were recruited to participate as control schools for this research. These schools are here labelled X,Y and Z. These control schools would not run the CASE@KS1 project during the 1999-2000 academic year, but continue with the normal school curriculum and their teachers were not given any specific information about the main project during this year. These seven schools were allocated by the main project director and LEA advisory teacher.

2.2.1 Experimental School A

This school is a state funded secular or county school. It has a one form co-educational entry with 196 pupils. Pupils are grouped in seven classes from reception to Year 6. There is also a unit for up to 20 pupils who have language impairment, and a nursery class. 84% of pupils come from minority ethnic backgrounds and nearly 50% from homes where English is not the first language. 31 languages are spoken in the school, and there is a fluctuating population of refugee and asylum seekers, many of who are housed in short-stay accommodation. Nearly a quarter of the school roll transfers each year. 61% of pupils are eligible for free school meals, which is above the borough average. 25% of the pupils in the main school are on the special needs register, with 18 pupils including those in the language unit, holding statements of special educational needs. Baseline tests of pupils entering the school at five years old show them to be below the average attainment level for the borough. In national tests at key stage one, just over half the pupils achieve National Curriculum level 2 or above in reading, writing and mathematics, whereas the national results are around 80% of pupils reaching level 2 or above in those subjects. The year one teacher involved in this project was newly qualified and undergoing her probationary year.

2.2.2 Experimental School B

School B is a Voluntary Aided primary school with 199 pupils on roll. 65% of the pupils come from minority ethnic backgrounds, with 48% coming from homes where English is not the first language. Baseline testing on entry to the school shows attainment to be average for the borough, but there is some concern about the low attainment of reception class children in English and social skills. 27% of pupils are identified as having special educational needs and 21% need additional support in English. 36.2% of the pupils are eligible for free school meals. There has been an ongoing problem with the instability of school leadership, a number of acting heads have led the school over the past four years and at the start of this research project the current head teacher was on long term sick leave. The year one teacher was newly qualified at the start of the year. Key stage one results show that the percentage of pupils reaching level 2 or above in reading and mathematics is in line with national averages and above the national average in writing.

2.2.3 Experimental School C

This school is a Voluntary Aided primary school with a roll of 231 pupils including nursery classes. 40% of pupils are from minority ethnic backgrounds, with 28% coming from homes where English is not the first language. A proportion of these children are given extra support through an Ethnic Minority Achievement Grant. One fifth of the school population is identified as having special educational needs and 27% of pupils are eligible for free school meals. On entry to the school, baseline tests show average attainment, but a significant number of pupils achieve above average results in mathematics. The year one teacher at the start of this project was experiencing difficulties with teaching and was subjected to monitoring by the Local Education Authority inspectorate. She left the school at Easter and a temporary, very experienced teacher, took over. The effect of this change will be further discussed in chapter 7, classroom observations and chapter 9, teacher interviews. Key stage one results show the number of pupils attaining level 2 or above in reading, writing and mathematics is slightly above the national average.

2.2.4 Experimental School D

School D is a Voluntary Aided primary school. Its catchment area is one of high-density population and is socio-economically disadvantaged compared to national criteria. There are 194 children on roll with 23 in the nursery. 40% of pupils are eligible for free school meals. This is above average for the borough. Ten pupils have statements of special educational needs, with a further 40 pupils on the school special needs register. Two thirds of the school population are from minority ethnic backgrounds and 52% are from homes where English is not the first language. Baseline assessments show the children to be slightly above average when they enter the school. Key Stage 1 results also show above average attainment for children reaching level 2 or above in reading, writing and mathematics. The year one teacher during this project was one of the more experienced teachers.

2.2.5 Control School X

School X is a Voluntary Aided primary school with 294 children on roll. Some classes are a mix of two year groups. The school's catchment area is diverse, ranging from professional owner occupied houses, to council estates and temporary accommodation. Almost 50% of the children come from ethnic minority backgrounds; there are 22 languages spoken in the school. 47% of children are eligible for free school meals. This is above the national average. 16% of children are on the school's special needs register, with four pupils having statements of special educational need. Baseline testing at school entry shows below the national average attainment level. At Key Stage 1, attainment of level 2 or above in reading and mathematics is still below the national average; but on the national average for writing. One problem the school faces is the high turnover of staff. The year one teacher was an experienced teacher who had returned to teaching after having time away.

2.2.6 Control School Y

School Y is a County primary school with a catchment area of mixed owner-occupied, rented and council property. A significant minority of pupils are from transient populations and come from a wide variety of ethnic groups, they often stay for only a short period. There are 371 pupils on roll. Attainment on entry to the school is very low compared to the borough average. 67% of children are eligible for free school meals. 92 children are on the special needs register with 2 having statements of special educational needs. Key Stage 1 results are below the national average in reading and writing and slightly above the national average in mathematics. The year one teacher was in her second year of teaching at the start of the research project.

2.2.7 Control School Z

There are 224 pupils on roll at this County primary school, with 20 in the special educational needs unit. There is a rich diversity of ethnic background with Somali and Arabic the major languages spoken after English. There is a high level of pupil mobility. 60% of pupils are eligible for free school meals. Baseline testing on entry to the school shows attainment to be below the borough average. At Key Stage 1 attainment is below national averages for reading, writing and mathematics. The year one teacher was newly qualified and in her first post. [Source: local education authority statistics]

3 THE RESEARCH QUESTIONS

The four main research questions are:

1. Can metacognitive ability be enhanced?

2. Are metacognitive gains related to cognitive/academic gains?

3. How is metacognition facilitated in year one classrooms?

4. What factors associated with teachers, impact on the development of metacognition in year one classrooms?

These questions were formulated through a process of connecting issues that emerged from the literature, about the development of metacognition and its connection to learning, with the CASE@KS1 programme, which proposes to develop metacognition. They are also informed by personal experience of teaching students in further education and perceiving there a general lack of metacognitive processing, in terms of reflection on and monitoring and control, of cognition.

The process of formulating these questions and designing the study provoked consideration of issues around the methods to be used. This study addresses the problems of how to study and measure metacognition. It combines existing tests with new methods of analyses and attempts to provide both a quantitative measurement of different aspects of metacognition and a phenomenological description of these, as they are experienced by five to six year olds. In addition, an original coding system of metacognition, as observed in classroom dialogues, was formulated by combining a theoretical approach with a grounded analysis.

The study concentrates particularly on the metacognitive development of the children, but as this is within an educational context, it is suggested that teachers will have some effect on how this development is facilitated. Thus, the project also considers pedagogic factors including a qualitative analysis of the teachers' own beliefs about themselves as cognitive beings.

The next item briefly outlines the project design before going on in further items to show how the design relates to each main research question and the sub questions contained therein.

4 THE RESEARCH DESIGN

This research took a quasi-experimental approach involving pre- and post intervention tests and interviews with 24 children – 6 from each of the experimental schools (Schools A, B, C, D) and with 18 children – 6 from each of the control schools (Schools X, Y, Z). The experimental group fell to 21 children by the end of the intervention year and the control group fell to 16 children by the end of the intervention year. The groups of six children were termed "focus" groups, for ease of reference. Classroom observations of CASE activities for each focus group in the experimental schools were carried out at two-weekly intervals during the year and observations of numeracy lessons for each of these groups was carried out once per term. Classroom observations of the focus groups in numeracy lessons in the control schools were carried out once per term. In total 48 observations were made of CASE activities in the experimental schools, 12 observations of numeracy lessons were made in these same schools and 9 observations of numeracy lessons were made in the control schools. The CASE activities tend to last around 30 minutes, whilst the numeracy lessons last for an hour. In addition, further data was gathered on three children (2 from the experimental focus groups and 1 from the control focus groups). This was gathered from before and after some of the observation periods, from informal conversations with these children and information from teachers. These data are used to form three individual case studies of the children in terms of their metacognitive development, (see chapter 8). All the teachers were interviewed at the beginning and end of the project. Further data were collected in the form of field notes made about contextual factors such as the classroom environment before and immediately after periods of observation.

Thus the full research study is as below:

4.1 Participants

School	Type	Children (present for whole project)	Teacher
A	Exp	2F 2M	Newly Qualified
B	Exp	2F 4M	Newly Qualified
C	Exp	4F 2M	Teacher C1 (Sept 99-Mar00) 3 years experience. Teacher C2 (Apr 00 to July 00) over 10 years experience
D	Exp	2F 3M	5 years experience

X	Cont	4F	1M	Over 10 years experience
Y	Cont	3F	3M	One year experience
Z	Cont	2F	3M	Newly Qualified

Totals: 4 experimental schools, 5 teachers, 21 children
3 control schools, 3 teachers, 16 children

4.2 Pre- and Post Tests

Administered individually to all the children

Pre-test	Post test
Test 1 Self as Learner	Test 1 Self as Learner
Test 2 Theory of Mind 1	Test 2 Theory of Mind 1 and 2
Test 3 Metamemory	Test 3 Metamemory
Test 4 Mental Rotation	Test 4 Mental Rotation

4.3 Classroom Observations

Case Tasks	12 X 4 experimental schools (approx 30mins each)	Total 48
Numeracy	3 X 4 experimental schools (approx 60mins each)	Total 12
Numeracy	3 X 3 control schools (approx 60mins each)	Total 9

4.4 Teacher Interviews

September 1999 interviews with teachers A, B, C1, D, X,Y,Z

Spring 2000 interview with teacher C2

July 2000 interview with teachers A, B, C2, D, X, Y, Z

Teacher C1 left the school at Easter 2000 and was not able to give another interview. Each interview lasted approx. 45 minutes.

5 THE DESIGN RELATED TO THE RESEARCH QUESTIONS

5.1 Research Question 1:

Can metacognitive ability be enhanced?

In order to approach question one, it is firstly necessary to have a conceptual framework of metacognition. As delineated in chapter 2, the conceptual framework used for this project is a developmental view based on the empirical research of Flavell, Brown and Wellman, (Brown, 1987; Flavell, 1979; Wellman, 1985b). The question involves answering a number of sub questions:

a) How is metacognition conceptualised for this research ?

b) What is metacognition for 5 to 6 year olds ?

c) How can metacognition be measured ?

d) Does CASE@KS1 as implemented impact on any factors of metacognition ?

Sub questions (c) and (d) are approached using a quasi-experimental method. A quasi-experiment has been described as "a research design involving an experimental approach, but where random assignment to treatment and comparison groups has not been used" (Campbell & Stanley, 1963).

Since true randomisation is very difficult within school settings and with the constraint of sample size used in this project, the quasi-experimental design used takes the form of pre-test, post-test, with established groups, matched as far as possible on grounds of school intake profiles. Each group of six children in the four experimental schools, (schools A,B,C,D), and the three control schools (schools X,Y,Z), were chosen by the individual teacher concerned, using the constraints of selection for all CASE@KS1 grouping. These constraints were that each group of six children should be of mixed gender and of mixed general aptitude; aptitude was determined by the teacher in each case. A threat to the internal validity of the experiment is possible due to reliance on the teacher for group selection. This is more likely to occur in the control schools where the teacher is not asked to divide the whole class into groups using CASE@KS1 criteria, but only those that would provide control focus groups for this and other small scale research projects. One way to strengthen the sample match is to note the pre-test scores for the main project in these seven experimental and control schools and compare these results with the pre-test scores of the particular 42 children who form the experimental and control focus groups for this project. A second way to strengthen this factor of the design is to compare the pre-test scores on metacognition from the four experimental focus groups with the pre-test scores from the three control schools. Chapter 6 shows that the experimental and control groups were closely matched in terms of pre- test scores.

Whilst the quasi-experimental method addresses sub questions (c) and (d) of the main research question (1): *Can metacognition be enhanced*; as the research progressed and theories of metacognition were sought from the literature, it became clear that a different approach was necessary to address sub questions (a) and (b). With the exception of Flavell's early work (Flavell, 1976), there was a lack of full descriptions of what metacognition is for five and six year olds in the literature. Even Flavell's work tends to analyse rather than describe, using a concept of metacognition akin to that described as an element of formal operational thought, (Piaget & Inhelder, 1969) and then seeing how far towards this goal the younger children have developed. A different approach from the measurement one was needed to get closer to the experience of "being metacognitive". To attempt this, a phenomenological approach was taken to the analysis of the qualitative data, arising from the tests and interviews. The adoption of this approach was gradual, developing through the piloting phase and informed by an iterative process between methodology, literature and method. A full description of this process and the method is found in chapter 5 and phenomenological descriptions of different aspects of metacognition are given in chapter 6.

5.2 Research Question 2:

Are metacognitive gains related to cognitive/academic gains?

This question includes the sub questions of:

a) What are cognitive gains?

b) What are academic gains?

c) To what extent are these measurements clouded by other variables?

The main research question requires a statistical comparison of the test results of cognitive development from the main CASE@KS1 project for the focus group children with the results from the pre- and post test results from the four tests of metacognition. The results of this are given in chapter 6 section 5.

As chapter 2 has described, the link between cognition and metacognition has been disputed by different theorists. In some cases these differences have relied upon the definition of metacognition as either stored metacognitive knowledge or a monitoring and control process. It seems clear that although inter-related, these two aspects of metacognition behave differently when subject to testing. For this research, in addition to comparing the pre and post test scores on the metacognitive tests with the results from the main CASE project tests, the scores are also compared with the results of national tests in English and Maths, taken at the end of year 2. These latter tests are taken as a measure of academic gains. Research question 2 is mainly addressed in chapter 6.

5.3 Research Question 3:

How is metacognition facilitated in year one classrooms?

The pilot phase for this research illuminated the issue of the teacher's theoretical knowledge of metacognition and her attitude towards its importance for learning, (see chapter 4). Thus research question 3 includes the sub questions:

a) Is metacognition apparent in year one classrooms?

b) What do teachers do to effect metacognitive processing in pupils?

c) Are teachers successful in provoking metacognitive responses from pupils?

d) What other variables affect the development of metacognition in year one classrooms?

The CASE@KS1 project gives high priority to professional development of teachers in terms of CASE method. Since metacognition is one pillar of the CASE programme, there is a given notion from CASE of what sorts of teacher behaviour might enhance metacognition.

The sub questions are addressed largely through classroom observations. Child-child interactions and teacher-child interactions are analysed, using a detailed coding scheme devised partly from the literature and partly from a grounded theory approach, (See chapter 7). There is a longitudinal aspect to this analysis as observations are carried out at regular intervals over the year. In addition, case studies of three particular children give an insight into individual metacognitive development over the year, (See chapter 8). Field notes provide a broader context to these observations and inform the questions used in the teacher interviews.

5.4 Research Question 4:

What factors associated with teachers, impact on the development of metacognition in year one classrooms?

This question addresses the role of the teacher in facilitating metacognition. It can be broken down into the following sub questions:

a) Does teachers' knowledge of and beliefs about metacognition impact on the development of metacognition in the classroom?

b) Do teachers' beliefs and opinions about teaching and learning affect the way they try to facilitate metacognition in the classroom?

c) Can teachers' ability to promote metacognition be developed through continued professional development?

These questions are addressed using data gathered from teacher interviews, classroom observations and field notes from interactions with teachers.

The four main research questions are thus broken down into sub questions and these often overlap and interlink. Therefore, a variety of research tools are used to answer the questions. The hypothesis tested by the quasi-experimental approach to question 1 is that metacognition can be enhanced and that CASE@KS1 lessons will aid metacognitive development. A further hypothesis from research question 2 is that metacognitive gains will be related to cognitive and academic gains. The approach taken to explore these hypotheses means that this part of the project could be replicated at some future date. This approach has also necessitated an original combination of tests to measure the construct of metacognition. The qualitative approach to the other research questions seeks to deepen understanding of the construct of metacognition and its development.

6 MEASUREMENT OF METACOGNITION

The theories of metacognition have been fully discussed in chapter 2 and as this topic is returned to again in chapter 6, it will not be discussed again here. The major problem with a quasi-experimental design is the reliability and validity of the instrument used as a measure. This question is particularly pertinent to metacognition, given the lack of theoretical consensus about metacognition, and the difficulties all researchers have had in measuring it. Rather than taking the view that metacognition can be measured as a single higher level cognition, the literature suggests that there are different aspects of metacognition, some of which may develop at different rates, for instance compare theory of mind with metacognitive strategy use. Thus it seems possible that metacognition is a complex network of psychological processes. From the literature, four aspects of metacognition were identified as relevant to the age group of the study and to the conceptual framework delineated by Flavell, (1979), on whose empirical and theoretical work this study is based. These are, knowledge of self as learner (self); theory of mind (others); metamemory (strategies) and mental rotation (task).

As Cornoldi (1998), has pointed out, metacognitive knowledge is different from other declarative knowledge, because metacognitive knowledge also involves the hard to define and verbalise feelings about the particular task and these aspects may be partly unconscious, although interacting with more conscious aspects. Yet in some ways metacognitive knowledge is also similar to declarative knowledge in that declarative knowledge also includes ill-structured information resulting from personal experience. Cornoldi's example is that whilst we may know that a cat is a mammal with four legs etc. our knowledge also includes personal information eg. that cats are nice animals. We use this knowledge to help us judge whether we would like other animals that are similar to cats. Given that like other forms of knowledge, metacognitive knowledge involves many overlapping aspects such as range of application, ease of access, level of awareness, coherence etc. it is very difficult to measure one individual's metacognitive knowledge in isolation. Cornoldi has produced a list of twelve sources of error of variability in the examination of metacognitive knowledge, (Cornoldi, 1998). Of these one of the most pertinent to this project is linguistic competence, (See below).

Typically, assessments of metacognition rely on inferences from classroom performance, ratings based on interviews of students questioned about their knowledge and cognitive processing, analysis of "think aloud" protocols, or assessments of difference between students estimates of their knowledge and actual knowledge determined by performance. The four tests described in chapter 6 aim to test aspects of metacognitive knowledge.

A great deal of research on metacognition has used versions of interview questionnaires devised by Kreutzer et al., (1975), Myers & Paris, (1978)or Borkowski & Peck, (1986). For example Swanson's research on the link between metacognitive knowledge and aptitude on problem solving used a version of the Kreutzer, Leonard and Flavell questionnaire which has questions focussing on person, task and strategy variables. An example of a person variable question is : "Q.5 Jim can play the piano, draw pictures and figure out math problems better than anyone else in the class. Do you think he's the smartest person in the class? Why?"

Before deciding on the measures to be used for this research, a thorough review of the various questionnaires used to measure metacognition and the numerous tests used (such as word list generation, story vignettes, performance estimate, strategy generating, prose organisation, peformance review) was undertaken. In addition, methodological issues of delayed response, as in video replay experiments, and researcher effects, both linguistic and paralinguistic, were considered. Ulitmately, the measurement of metacognitive processes used in this project was decided by information from the pilot study (see chapter 4). Among other things, the pilot study highlighted questions around the children's age and linguistic ability. From both a review of the literature on measurement of metacognition and experience from the pilot project, I concluded it was necessary to:

1) provide tactile stimulus for children of this age

2) base questioning on their responses

3) take account of researcher effects but not try to unnaturally neutralise them

4) base each test on one main metacognitive factor, rather than mixed as in the questionnaire method

5) keep the interviews as natural as possible

6) analyse the data in more than one way

7) consider other external factors such as time of day

Thus, whilst the analysis of the tests is quantitative the administration of the tests has more in common with the qualitative methods used in interviews.

7 LANGUAGE

In researching with young children the researcher needs to be sensitive to the linguistic ability of the child, both in its receptive and expressive modes. However, language is also influenced by many other affective factors, such as motivation to think about the question, construction of purpose of the question and the status and role of the researcher. It is just as easy to over estimate children's knowledge of their own thinking, as it is to under estimate it. Lucky guesses, leading questions and para-linguistic cues, can all account for unreliable data. In a similar way personality (shyness etc.) and affective factors (tiredness, boredom) along with cognitive factors (incomprehension, attention span) can all lead to under estimates of children's metacognitive competence. Asking questions and gaining answers is not a one way system. The answers the children provide, along with their behaviour, co-operation or not, will affect subsequent questions and behaviour of the researcher. Whilst professionalism as a researcher will seek to minimise these effects it is naïve to believe that they can be neutralised.

There is a well-documented tendency amongst young children for them to feel compelled to answer questions and provide a correct answer. Work by Hughes and Grieve showed that four year olds would answer non-sensical questions without questioning the question, (Hughes & Grieve, 1980). In addition, repeated questions have been found to cue a change of response, as the repetition is interpreted as an indication of an incorrect answer, (Rose & Blank, 1974). Also constant probing for details can lead to invention, (Ceci, 1991).

Given these social and linguistic difficulties and add to that other factors, such as tone of voice, accent and rapport, producing reliable data from questioning small children is a minefield, through which researchers must tread very carefully. The pilot study for this project was crucial in illuminating these threats to validity.

Whilst awareness of these problems is necessary in a reflective approach to research, some practical solutions can also be employed to strengthen data reliability. Firstly, all tests and interviews with children and teachers and all classroom observations were audio-taped. Listening to these tape recordings and transcribing them verbatim, provides clues to where some of the above problems have occurred. This picks up misunderstandings, repetitions, leading questions, distractions etc. However, analysis of pauses, long and short need further elaboration. They could be construed as "thinking time" or boredom and disengagement. Field notes taken at the time aided correct interpretation. Contextual field notes were also made prior to and after the particular interaction. These included factors such as: the environment, time of day, perceived mood of both the participant and researcher, and the activities engaged in just prior to and just after the interaction. For example, had the child been taken out of a PE lesson to talk to me? Did my interview/tests encroach on a playtime or lunchtime? Had the teacher had a successful lesson prior to my interview, or was she going into a staff meeting, or as in one case, a parents' evening? My own thoughts and feelings of how the particular interaction had gone were also recorded.

A fuller picture of the data collected is achieved through the research design of triangulation of tests, classroom observations and teacher interviews and through multi-method analyses. The methods of analyses used are described in subsequent chapters under each particular aspect of the research.

8 ETHICS

"Research with human participants is an intrusive process",(Lindsay, 2000). Lindsay goes on to suggest that in considering the ethics of a project, we need to look at the research participants, the research task and the interaction between the two. In addition, I believe it is necessary to look at the motivation of the researcher in conducting the research. Motivations can be seen to be on a scale from purely altruistic to self-aggrandizement. Similarly, the effect of research on participants is a matter of degree. In some areas of research, most notably medicine, strong ethical guidelines are laid down by professional bodies, who also have the power to curtail or disallow any research they perceive to be unethical. Similarly, the British and American Psychological Societies have a code of conduct which may lead to transgressors being struck off the register of chartered psychologists. However, not all researchers engaged in psychological or educational research with a psychological content, are members of these bodies. Many educational researchers will consult and abide by BPS codes of conduct or by the British Educational Research Associations own code, although this latter has little ability to enforce its recommendations. There seems to be a view amongst educational researchers, that people engaged in research with children (ie. people under 18 years of age) in educational settings, have an in-built integrity, which would disallow harmful research. It is usually peer review of educational research that protects participants from unethical treatment. However, my own experience of conference presentations and published papers is that the ethical guidelines considered in the research are rarely made overt. This can be contrasted with other areas of research such as health, medical and animal research where the ethical considerations are described and where ethical clearance from a professional ethical committee has been sought.

In addition to the effect of the research on participants, another aspect of ethical research is the degree to which it is objective, unbiased and non-polemical. In this sense, the funding of the research, and its subsequent dissemination needs to be considered. In the late 1990's a report entitled Educational Research: A Critique addressed this notion of partisanship in educational research. It found that in a random survey of recently published papers of educational research in major educational research journals, only one third met many or all of a list of quality criteria, including rigour, sampling, use of primary sources and avoidance of partisanship, (Tooley & Darby, 1998). As Lindsay points out, although the Tooley report does not directly speak of ethics, the concept of partisanship is related to "basic principles, especially integrity and competence"(Lindsay, 2000). Lindsay, however goes on to criticise the same Tooley report for it's own sampling methodology.

The majority of educational researchers will follow guidelines produced by either British Educational Research Association (BERA) or American Educational Research Association (AERA). Section 7 of the BERA guidelines refers directly to responsibility to the participants:

> "Participants in a research study have the right to be informed about the aims, purposes and likely publication of findings involved in the research and of potential consequences for participants, and to give their informed consent before participating in research"

and section 8

> "Care should be taken when interviewing children and students up to school leaving age; permission should be obtained from the school, and if they so suggest, the parents"

and section 10

> "Participants have the right to withdraw from a study at any time".

The difficulty arises in conducting research with children in a school setting. For instance, how far can young children be said to understand the purposes of the research, even when the researcher takes the trouble to explain it? or even less likely, how far can they be said to be aware of the potential consequences of publication? BERA's solution is that consent should be obtained from the school and then maybe from parents. However, once a school has given consent, it seems less likely that an individual participant would choose to withdraw. As much as the individual researcher may wish to find some degree of equality of power with the research participants, the institutional power structures will make this more problematic. In large quantitative studies these issues may not be so important, but in small-scale, qualitative studies, the relationship between the researcher, participant and research task, needs to be analysed as part of the research findings.

The research carried out for this project is set within the framework of the larger CASE@KS1 project and as such permissions had already been obtained from the local education authority, schools, parents and teachers. For this study, I was careful to explain to each child participant that my job was to find things out and that I was trying to find out how children learn things. I explained that I would do this by going to lots of schools and seeing lots of children. I would ask the children to solve some problems and talk about how they had solved them. I would record all the questions and answers on a tape recorder and later at home, I would type up the words and see if different children say the same things. I emphasised that I was not testing children for right or wrong answers. I then asked "Do you want to do this with me or do you want to carry on with what you're doing?" All but one child wanted to be involved. This was a not unexpected response, since the natural curiosity and a desire to help in children of this age, was predictable. The one child, who didn't want to be involved at first, changed his mind before I got to the classroom door and was included.

Before testing began I introduced myself again, made some informal conversation with each child and showed them the tape recorder and microphone. Within time limits, they were allowed to explore the machine and hear their own and my voice. I also stressed that they could stop doing the activities if they needed to for any reason. I reiterated this throughout the test/interviews and sometimes curtailed the questioning, where I perceived a child was feeling tired or uncomfortable, although they had not verbalised it. All the children completed all the test/interviews.

A similar regard to informed consent was taken when interviewing teachers. In this case confidentiality and future dissemination of the research were also stressed. Classroom observations were also undertaken with care to provide information to the observed group, including the teacher, about the purpose and recording of the sessions.

Many of the issues outlined above became evident during the pilot project. The next chapter outlines this pilot study and indicates how it informed the full research project.

Chapter 4

THE PILOT STUDY

1 INTRODUCTION

In March to July 1999 a small scale study was undertaken. This gave an opportunity to trial the test materials for one metacognitive factor, to try out an interview schedule with teachers, to undertake classroom observations and to try methods of field note collection. Due to time and access constraints only one metacognitive factor was tested during Phase 1 of the pilot study. At this stage the research design was still vague but the broad research questions were formed.

2 PHASE 1: THE MENTAL ROTATION TEST

The aim of the test was to see if, by presenting a mental rotation exercise as stimulus and asking children how they solved the problem, I could obtain answers that would show an understanding of mental functioning. It was not clear, at this stage, whether year one children would talk about how they had worked out the problem, or whether they would understand the problem.

The test was adapted from a computerised test by Estes, (1998), from whom permission was obtained. Four cards were produced. Each card bearing a pictogram of two monkeys. Each monkey has one arm in the air. On Card A both monkeys are standing upright with their right arms in the air. On Card B both monkeys have their left arm in the air, but the second monkey has been rotated to 90°. On Card C the first monkey has his right arm raised and the second monkey his left arm, the second monkey has been rotated to 120°. On Card D the first monkey has his left arm raised and the second monkey his right arm raised. The second monkey has been rotated to 180°, (see chapter 6 page 225 for a copy of the test)

Eight children were selected: three boys and five girls from two year one classrooms within the same school. The school was one in which much of the main CASE project pilot study was carried out and would not be used later in my study. The children were chosen on the basis of conservation and drawing test scores from the main project. Two children (interviews 1 and 2) had high score on both conservation and drawing; two children (interviews 3 and 4) had low scores on both conservation and drawing; four children (interviews 5, 6, 7 and 8) had lower than average conservation scores, but higher than average drawing scores. The aim was to get as good a sample mix as possible with such limited numbers.

2.1 Administration

A scoring sheet was devised (see appendix 4.1), on which was given details of the individual child, age, sex, conservation and drawing test scores and then the questions I intended to ask. For each card the following initial question was asked:

"Have the monkeys got the same arms in the air or different arms ?"

Follow up questions were:

"How did you do that ?" or "How did you work that out ?"

"What was difficult about it ?"

"What was easy about it ?"

"Can you tell me what you said to yourself when you were doing it ?"

"Can you tell me what things you thought about to help you do this ?"

The children were informed of the research as outlined in ethics above.

The tests were audio taped and fully transcribed. The original scoring method used symbols :

□ to indicate a non-mental answer

O to indicate a general mental answer

Δ to indicate a mental rotation answer

(The categories are from Estes original test and are further elaborated in chapter 6)

In all cases my interest lay with the explanations rather than correct solution of the problem. There was no attempt made to correlate correct answers with explanations because each child was only given four cards to solve and so the probability of getting all four correct would be high. This is a limitation of adapting the test in this way. In asking the follow up questions I allowed myself to prompt further answers if none were forthcoming.

2.2 Results

Initial analysis of the data showed:

Interviewees 2,3 and 5 gave total non-mental answers

Interviewees 1, 4, and 7 showed a greater amount of mental awareness, with interview 1 being the weakest. Yet all three needed prompts.

Interviewees 6 and 8 showed most mental awareness, although neither got all the cards correct. Their conservation and drawing scores were also similar being below average on conservation and above average on drawing.

2.2.1 Non-mental Answers

Interviewee 2, Shamarl, tried to physically move the card around. She gave long descriptions of which way up the monkey was and what would happen if the cards were turned around. She physically turned backwards and forwards. She was unable to articulate her explanation, but seemed to have an awareness of the need to turn the monkeys around. Shamarl in common with interviewees 3 and 5 maintained her non mental answers even when given very explicit prompts :

Researcher: *"Did you have to say anything to yourself to work it out?"*

Shamarl: *"Nn Nn"*

Researcher: *"Did you have to think about it?"*

Shamarl: *"No"*

Similarly, interviewee 3, Naomi also tried to turn the card around and she resisted prompts to give mental answers. Interestingly, at the end of the interview when asked:

Researcher: *"Which bit of you are you using to work this out?"*

Naomi replies: *"hands"*

Using physical gestures to indicate turning was also used by other children who gave more general mental answers.

2.2.2 Some mental awareness

The interviewees, 1, 4 and 7 showed a greater amount of mental awareness. In interview 4, Mohammed began with a confidence in left and right:

Researcher: *"How did you work that out?"*

Mohammed: *"Because I know how to do it. Because I know, because he's doing his right hand down, he's doing his right hand up and left hand down and left hand up".*

However, later in the interview as he physically rotated the card:

Researcher: *"When you put your fingers on you were sort of going this way round weren't you, what were you trying to do when you did that?"*

Mohammed: *"Mmmm, I was trying to think how to do it"*

Similarly interviewee 7, Luke, also gave this response:

Researcher: *"What are you doing to figure it out?"*

Luke: *"Trying to think of it"*

Whilst Luke maintained his thinking explanations with elaboration of *"I think in my head"* he still sought to physically manipulate the cards and when asked specifically about mental rotation:

Researcher: *"How could we turn him around without turning the card around ?"*

Luke: [Silence]

Researcher: *"Could you turn him around in your head ?"*

Luke: *"No"*

In this category of answers interview 1 with George showed that he gave non-mental answers unless explicitly prompted, when prompted he picked up and repeated my language:

Researcher: *"Can you tell me what you thought about when you were doing this one?"*

George: *"I thought about. Well I was going to say that this one was the same but I changed my mind"*

Researcher: *"You think it's different now?"*

George: *"Because I thought that one is facing sideways and that one facing up"*

However, when this prompt is removed, George reverted to non mental answers:

Researcher: *"How did you work that one out?"*

George: *"Well, I saw that one down and this one up":*

Researcher: *"Did you do anything with the one that was facing down ? to show you that it had the same hand or different hand"*

George: " *I just looked at the picture"*

Researcher: *"Did you say anything to yourself when you were looking at the picture?"*

George: *"No"*

Researcher: *"Did you think anything?"*

George (No answer)

2.2.3 More Mental Awareness

Two interviewees: 6 and 8 were classed as having most mental awareness.

Interview 6 with Sara showed that she immediately gave general mental answers:

Sara: *"That's what I think"*

Sara: *"Yeah, you have to look at it and think"*

Sara: *"Because I thinked about it quickly"*

Later on Sara expressed her difficulty in explaining:

Researcher: *"But you knew they had different hands in the air, how did you know that?"*

Sara: *"Because. It's hard to say, but it's because if that was standing like that yeah"* [indicating turning one monkeys the right way up] *you would see that his* *hand is down and his hand is up and his hand is up and his hand is down. That's why it's different.*

Similarly Interview 8 with Cassandra begins with spontaneous general mental answers:

Researcher: *"How did you work that out?"*

Cassandra: *"Because my brain told me"*

However, when pushed for further explanation she tries to describe:

Researcher: *"How did you work this one out?"*

Cassandra: *"I tried. I tried. I tried and twisting and my* [long pause] *body helped me and my body told me that they were the same"*

Researcher: *"Which part of your body told you?"*

Cassandra: *"My head"*

Researcher: *"Was there any other part of your body that told you?"*

Cassandra: *"No"*

Researcher: *"No? last time you said your brain told you last time, but this time .."*

Cassandra: *"this time my head helped me to turn them around."*

3 HOW DID THIS INITIAL PHASE OF THE PILOT STUDY INFORM THE MAIN STUDY ?

Firstly, I confirmed that it was possible to use a mental rotation task to prompt children of this age to talk about solving problems and about thinking. The adaptation of the test from computer to card and the limited time available meant that it would not be possible to correlate qualitative answers with performance. The test proved to be challenging and interesting for the children. The qualitative data showed a number of ways in which the children tried to explain their thinking whilst solving the problem and expressions of difficulty, in providing explanations from such young children, indicated that they were really trying to answer my questions. The test was easy to administer and provided good qualitative data. The scoring sheet was abandoned as a distraction from focussing on the children's answers and responding appropriately.

Analysis of these results also indicated the ease with which children of this age can be led to give certain answers. Frequently my own use of particular words "I think", "do" were repeated in the child's answers. George's interview in particular points this up. When I speak of thinking so does George, when I don't, neither does George. Another factor in this analysis was the tendency for children to not only give non-mental explanations for their answers, but to go further and claim physical explanations, such as "my hands helped me" or "my body told me" or "I just looked". There appeared to be not just a lack of a logical explanation of how to solve the puzzle, but another type of explanation. It would be interesting to see if this was manifest in the main study and if it is a developmental trait, common only to the youngest children.

In order to investigate this pattern further and to test other possible metacognitive factors a second phase of the pilot study was undertaken.

4 PHASE 2

Two weeks later the same school was revisited. This time six children (3 boys and 3 girls) were selected from a year 6 class (the last class of primary school before transfer to secondary school average age 10.3). The aim was to see what difference if any, the age difference would make to their answers and also to test the reliability of the test and the methods of categorical analysis. The children were chosen by their teacher to reflect a mixed attainment profile.

Test/interviews were conducted individually with each child. These were conducted in the library, which is open plan and subject to background noise. Again the stimulus was the mental rotation cards, but this time the interviews were extended beyond explanations of mental rotation to encompass questions based on Flavell's model of metacognitive knowledge. It was explained to these 10 year old participants that I was trying to find out how younger children learn things and the differences between how six year olds and ten year olds solve problems.

Two children, Lola and Jason were described by their teacher as high attainers; two others Nicky and Paven were described as middle attainers and the other two, Conrad and Kaysha were described as low attainers. The teacher commented on two individual students. Lola she claimed was of very high attainment compared to the rest of the class and Conrad was lower than the other low attainers in the class.

The interviews were coded for metacognitive knowledge, general awareness, awareness of others as cognitive beings and any description of knowledge or strategies being transferred from one domain to another.

4.1 ANALYSIS

All except Conrad gave specific mental rotation explanations for the test. Conrad gave a general mental explanation.

4.1.1 Metacognitive knowledge – Person Variable

All the children were aware of themselves as learners, but to different degrees of sophistication:

Conrad was aware that he finds some things difficult to do and why that might be

L.18 Conrad: *"sometimes its difficult"*

L.38 Conrad: *"It could be because its too hard and too long ... if its time it would probably be hard.*

L.40 Conrad: *"sometimes I know that I've forgotten it and it come back into my brain and I remember it"*

Conrad displays a view of himself as a learner at age 6 and a view of what other six year olds might find difficult:

Researcher: *Do you think there was any difference between the way you used to think about things when you were six and the way you think about things now ?*

Conrad: *No, I didn't used to think when I was six.*

Researcher: *"Do you think if I gave this monkey problem to a six year old, they would have a way of working it out?"*

Conrad: *"Yeah, if they think about it hard and if they pretend that that man is standing up and they put him sideways straight with each other"*

Jason had a similar view of himself at age six but knew that he had changed

Jason: *"Because I know now any time I think, I'm not wandering about, my head's always* [unable to hear] *....the easiest, but when I was little and I used to think, actually I didn't use to think when I was little"*

Kaysha too was aware of herself as a learner and was specific about why she may find some things difficult:

Kaysha: *"if I didn't know properly it would be because I haven't studied it or I haven't been paying attention properly in class"*

She showed awareness of herself as a learner:

"I have a good memory", "little things I can forget", "I know we studied it but I wouldn't quite remember how to do it"

She was also able to reflect on how she was answering my questions whilst answering them:

Researcher: *"... how are you answering my questions about how you work things out?"*

Kayasha: *"I'm just thinking of what I've learnt in my past"*

Nicky was aware of the need to concentrate and use strategies

Nicky: *"cos you have to picture in your head and if you picture it it's kind of hard to turn it around with your brain, you have to concentrate really hard then you will be able to do it"*

Asked about doing a difficult math or science problem :

Nicky *"I read the questions first and if I still don't understand it I read it over and over again until I understand it, ... if I get it wrong I'll ask the teacher to explain it properly to me so that I'll know the next time."*

Lola described by her teacher as a high attainer, gave a sophisticated answer for her ability to do the rotation test:

Lola: *"I've done a lot of non verbal reasoning before"*

She showed awareness of her memory and how it works and how past learning can aid present problems, when asked about solving novel problems:

Lola: *"well I have to apply the things that I've learnt before to solve the problem, or if I can't apply any of the things then I'll have to ask the teacher"*

4.1.2 Strategies

All the children were aware of strategies they used to help them. These included: *"asking others"*, *"asking the teacher"*, *"thinking about it"*, *"remembering how to do it"*, Jason speaks of *"backtracking"*, *"writing it down"*, *"working it out on paper"*

Paven spoke of *"find a way to make it look easier"*, he mentioned using a drawing of a cake to work out fractions and writing things down.

Nicky emphasised reading the question until it's understood or looking back at notes taken in class.

Lola suggested knowing the opposite of something can help:

Lola: *"well if I can use inverses, I could do the inverse of it to see and then do the inverse again to help me, so if I know the opposite of it it helps me to do that question"*

She also described turning the monkeys around in her head to see if they had the same hand in the air.

Conrad gave a complicated multiplication strategy for x9 but it seemed very confusing and he admitted it only worked for x9 and not any other multiplication.

Jason couched his answer to solving difficult or new problems in affective terms

Jason: *"well if it's a problem like someone's upset at first I always try to find out what's their problem and try to solve it"*

None of the other children interpreted the question in this way, but it would be interesting to find out if children use different methods for solving emotional problems compared to cognitive ones.

4.1.3 Transfer

Four of the children: Lola, Paven, Nicky and Kaysha described transferring learning from one domain to another:

"it's like I do in science", "I've done a lot of non verbal reasoning" "maths work and stuff like that helps" "when I do maths work to solve problems you have to use

your imagination or story writing you could use your imagination and turn things around" "most of the things I do are similar to the things I've done before"

5 HOW DID PHASE II OF THE PILOT STUDY INFORM THE MAIN STUDY?

The qualitative analysis of data gathered during this phase showed clearly a developmental factor in children's ability to explain their own thinking. By the age of ten all the children in this sample could explain how they solved problems and what strategies were available to them. In general they said that they were aware that they had developed their thinking skills over time and they could describe the difference between being six and being ten years old. They were able to talk about problems they had solved in other areas and how they had used their memory and memory aids. They showed a knowledge of how their own mind works and the importance of concentration and attention. All the children performed well on the mental rotation task. This is in line with Estes' results, thus giving the task a degree of reliability. Only Conrad failed to rotate the cards and to provide specific mental rotation explanations. Phase II also indicated another area of study: that of emotional problem solving in comparison to cognitive problem solving. This is an area that the main study would not seek to investigate, but it would be an interesting comparison.

Following these interviews, an informal conversation with the class teacher inadvertently suggested issues that might be addressed in the teacher interviews.

The teacher had been these children's class teacher the year before. In year 5 she told me, the whole class had taken part in a "Thinking Skills" programme, which had lasted two terms. When I asked her more about this she appeared vague, not recalling the name or author of the programme, but stating that she had a book about it in her room. I asked if it had had any effect. She said she hadn't seen any improvement in the children "especially no improvement in thinking". I asked if she continued to use the thinking skills methods in her class. She said there was no time now "the curriculum is too bitty". She thought she sometimes involved thinking skills in PSI lessons (personal and social issues). Her concluding remark about her class was "Some don't seem to think at all". She indicated that the non thinkers were the lowest attainers "like Conrad". My own experience having just interviewed six of her class was obviously different. In direct conversation they had all explained their thinking, displaying various degrees of metacognitive processing across different factors. In wondering why our conclusions differed so markedly I began to question the influence of the teacher's own knowledge of and attitude towards developing metacognition in children. This would later help me to formulate questions for the teacher interviews and direct some aspects of the classroom observations. These aspects of the main study were worked out further during phase III of the pilot study.

6 PHASE 3

Four months later, in the summer term the same school was revisited. Three children from Phase I, Shamarl, George and Sara were tested on four metacognitive factors. The four tests were:

1. Mental Rotation [monkeys]
2: Theory of Mind [smarties]
3. Self as Learner [blocks]
4. Metamemory [toys]

The mental rotation task has already been explained. The second task was the classic theory of mind/false belief task using a smartie tube. In this test the interviewer first shows the child a smartie tube and asks "what do you think is inside?" The child usually answers smarties or sweets. The interviewer then shows the child that the tube really contains crayons. The crayons are placed back in the tube and the child asked "now if your friend was to come in and I asked her/him what was in the tube what would s/he say?" If the child shows that they are aware that the friend has no real knowledge of what is in the tube and therefore will infer from the packaging that it contains sweets, the child is said to display a theory of mind, (Wimmer & Perner, 1983). The third test consisted of asking the child to count five blocks and then asking them how they had learnt that and if they had always known how to count or if there was a time when they couldn't count. The fourth test involved remembering up to sixteen related toys once they had been covered up and then explaining how they had remembered them.

In phase 3 there was a slight difference in performance on the mental rotation task compared to phase 1. This time Shamarl gave more general mental answers than before, but George, unprompted, remained with non-mental answers and did not change. All three children succeeded on the theory of mind test. This is in line with the literature where most children pass this test by the age of four. The self as learner test showed that all the children were able to talk about themselves as learners and gave various explanations of how they had learned to count such as "my mum taught me", "learnt in nursery", "learnt from poster on bedroom wall". The metamemory test provided rich data with the children describing strategies they use for remembering, such as making stories out of the objects, naming the objects out loud or to self, and knowing that they had forgotten some of them.

During phase 3, four classroom observations were carried out. Two were CASE lessons being trialed in the school and the other two were numeracy lessons. The aim as observer was to be as non-participatory as possible. Initially a contact summary form was used for each observation. The form included the following headings:

1. time and date of lesson, start and end times, description of classroom environment, perceived atmosphere of class (eg. quiet, noisy, ordered etc.)
2. details of teacher, length of service, style (eg. asking questions of whole group or of specific children), how discipline is maintained.
3. Summary of lesson content

4. Any obvious examples of metacognitive behaviour
5. Particular aspects of CASE lesson eg. concrete preparation
6. New questions, places to look, thoughts and perceptions

The observations were also audio taped using a microphone placed in the centre of the table during the CASE lesson or as close as possible to the class during whole class teaching, as in the numeracy lesson. One lesson was also video taped, although video was later dropped as a method, as it was thought to be too intrusive and a distraction from closer listening and note taking. The audio tapes were transcribed.

Informal chats with the teachers were also included, where this was relevant to metacognition.

In addition, an interview schedule for teachers was piloted, during this phase, with two teachers, who would not be involved in the main study. The questions covered details of teaching experience, details of teacher training related to theories of metacognition, teachers' perceptions of their own teaching style, their thoughts, beliefs and knowledge of metacognitive theory and the teacher's own metacognitive development. The teacher was also asked to comment on the interview questions and the experience of being interviewed. The interviews were audio taped and transcribed. In one case the transcribed interview was given back to the teacher for comments. Field notes were taken at the time of the interviews regarding my first impressions of how the interview had gone and other factors regarding my performance as interviewer along with my perceptions of how the teacher was perceiving me.

(Further discussion of factors pertinent to classroom observations and teacher interviews is found in chapters 7 and 9)

7 HOW DID PHASE III OF THE PILOT STUDY INFORM THE MAIN STUDY?

Repeating the mental rotation test and adding the other tests allowed me to formulate future questions and to be aware of the effects of leading questions. The four tests proved to be reliable in prompting children to talk about thinking. The false belief test (Smartie tube), as predicted by the literature, resulted in all the children of this age group providing theory of mind answers. Whilst a theory of mind test is important for a study of metacognition, it seemed that the false belief test would not be adequate as a sole test of this aspect. A return to the literature found a theory of an interpretative theory of mind developed by Carpendale and Chandler, which appeared to allow for developmental discrimination at this age, (Carpendale & Chandler, 1996). Although this new test was not ready for the pre-testing phase in September 1999, it was incorporated into the post tests in July 2000. Further discussion, description of the test and results can be found in chapter 6. Phase 3 of the pilot study also determined the order in which the tests would be administered.

The final order was:

Test 1: Self as Learner

Test 2: Theory of mind (Smarties in September; Treasure chest and Interpretative test in July)

Test 3: Metamemory

Test 4: Mental Rotation

The order meant that the tests began with the easiest, and ended with the most difficult. The pilot study had shown that the metamemory test was the one most enjoyed by the children, as it involved lots of little toys, and placing it third both kept their enthusiasm going and provided some fun.

Undertaking a pilot study was particularly necessary for this project, as once the experimental year began, it would be very difficult to change any of the methods used, since all data would have to be gathered during this one academic year. During the year, as I reflected on the data gathered, codings and analyses were further developed. The pilot study allowed me to develop coding systems for the pre- and post tests used and for the classroom observations. Whilst the tests were originally only coded for categories of metacognitive processing in order to show change between pre- and post test results, during the experimental year I found that this method alone was leaving out a great richness of data. A return to the literature, in this case to philosophy, found a method of analysing such rich data using a phenomenological approach. This approach was used in the final analysis along with the more quantitative analysis. The precise method used and its theoretical underpinnings are described in chapter 5.

8 CLASSROOM OBSERVATIONS

Initial coding for the classroom observations was done using an open coding method, distinguishing instances relating to the six CASE pillars and other aspects of classroom behaviour. Transcripts of audio taped observations integrated with field notes were coded as follows:

8.1 PILOT OBSERVATION CODINGS

Setting

Sat around table – child, teacher same	1
" " " " " different	2
Children standing, teacher same	3
" " " different	4
All on carpet	5
In normal classroom	A
Separate room	B
Support staff present	i, ii, iii etc
Others present	x, y, z

CONCRETE PREPARATION

Children allowed to touch & talk about things

Children not allowed to play with materials

All teacher questions relating to nature of materials

All child-teacher interactions relating to comprehension of materials

All child-child interactions exchanging knowledge about materials and strategies

Teacher gives information about materials

Teacher asks for ideas about what do with materials

Teacher gives orders about what do with materials

COLLABORATIVE WORKING

All refs by teacher about working as a group

All refs by child about working as a group

Child-child comprehension questions

COGNITIVE CONFLICT

All refs by child to puzzlement

All refs showing teacher asking for evidence – how/why questions

All refs by child explaining their views

Non-verbal explanations

CONSTRUCTION

Child-child interactions with ref to each other's ideas to resolve conflict

Teacher-child refer to ideas of different children

Child refers to past experience

Child refers to past knowledge

Teacher questions to elicit understanding

METACOGNITION

Child reflects on ease/difficulty of task

Child shows general mental awareness use of I think etc.

Child refers to own use of rules/strategies

Teacher specific intervention to elicit above

BRIDGING/TRANSFER

All refs by child to similar/other activities

Teacher attempts to promote bridging

DISCIPLINE

All refs to teacher-child discipline

All refs to child-child discipline

Teacher gives praise statements

Child-child praise statements

8.2 REVIEWING THE CODING SCHEME

However, whilst initially useful as a method of examining the complex nature of the classroom interactions, it soon became clear that attempting to analyse such vast amounts of data was in danger of obscuring the instances of metacognitive processing that I was attempting to find. Later and during the experimental year a more focussed coding system was developed, based upon metacognitive theory for the children's interactions and a grounded theory approach for the teacher interactions. As this project has a theoretical base in the model of metacognition described by Flavell, this was used as a way of searching the transcripts for children's behaviours that could be coded as metacognitive in line with this theory. When a behaviour was found the teacher interactions surrounding it were coded to form descriptive categories of their behaviour. The coding systems are explained and analyses given in chapter 7. In this way the classroom observations emphasised the metacognitive instances seen, rather than trying to analyse the multitude of interactions present in a year one classroom.

9 TEACHER INTERVIEWS

The two pilot interviews undertaken in Phase 3 allowed me to formulate the questions to be asked. At this stage the interview schedule was quite structured. It focussed on the teacher's own knowledge of theories of metacognition; her opinion of its usefulness for learning; any examples of children being metacognitive; any strategies used to facilitate its development; any personal experience of the role of metacognition in her own life and her opinion of whether metacognition could, in fact, be taught. It was obvious from the pilot interviews that I would need to explain my theory of metacognition before I could elicit answers to these questions. The pilot interviews went well. I appeared to establish a rapport with the teacher and they provided thoughtful answers. However, an initial analysis showed that the teachers were concerned with other aspects of teaching and learning and often veered the conversation away from metacognition onto their own more pressing concerns, one in particular being the effects of the National Curriculum on their teaching. The problem was then how to keep the questions focussed on my research area, without closing down the interaction. The first interviews for the main study were undertaken using much the same schedule as for the pilot interviews. However, during the experimental year I began to have doubts about the method I was using and a return to the literature provided me with a more theoretical base for the post intervention interviews carried out in July 2000. The full story of how the interviewing technique developed and analysis of both pre- and post intervention year interviews with the eight teachers involved is covered in chapter 9

One limitation of the main research study, was that teachers had to be interviewed when access was allowed by the CASE project. This meant that in July 2000 all three control school teachers had to be interviewed on the same day, whilst they were released from school for a CASE professional development day. This was hardly ideal, as some teachers also had to be interviewed on the same day by other researchers on the CASE project. However, they all engaged in the interview process fully and the data gathered was both rich and rewarding for this research project. The teacher interviews also provided the data relevant to research question.

4: What factors associated with teachers impact on the development of metacognition in year one classrooms?

10 SUMMARY

By the beginning of the experimental year, September 1999, the pilot study had allowed me to design the research project. This would consist of a quasi-experimental approach using pre- and post intervention tests on four metacognitive factors, with twenty-four children from the experimental schools and eighteen children from the control school. This approach would be supplemented by triangulation with classroom observations and information about the teachers from interviews at the beginning and end of the year.

During the classroom observation period, I began to focus on individual children and decided to incorporate a small case study element into the main project. The aim of this, was to try and track the development of metacognition in three individual children. Although gathering data in one chunk over a year can be a limiting factor on the research, it was necessary and possible during the year, to reflect on the process and change some aspects. In this way, the research methods developed in response to the data gathered. Further discussion of particular aspects of the methods used and analysis of data is provided in future chapters.

This chapter has explained how the pilot project influenced the design of the main project. A particularly significant aspect of this research is an attempt to describe what metacognition is for children of this age. In order to do this a phenomenological approach was taken to the interview data from the four tests of metacognition. This method is outlined and discussed in the next chapter before the results of it are given in chapter 6.

Chapter 5

A PHENOMENOLOGICAL APPROACH TO METACOGNITION

1 INTRODUCTION

The research design and methodology as described in chapter 3 has a quasi-experimental approach. This is partly a result of the relationship between this research project and the main CASE@KS1 project. One aspect of this research is to evaluate CASE@KS1 in terms of its ability to facilitate metacognition in year one children. As a result, the project is designed with an element of measurement of metacognitive development and a consideration of all the problems seeking to measure this entails. However, this aspect of the research, although it shapes the way data is collected, is not the most important aspect. Throughout the research and overriding all the research questions is the fundamental question of what is metacognition for children of this age. As chapter 2 pointed out, theoretically there is debate as to whether it is possible for children of this age to display metacognition, or whether this is only possible with the onset of formal operational thought, as Piaget suggested, (Piaget & Inhelder, 1969). There is also, connected to this, the philosophical problem of whether metacognition is a cognitive psychological model, designed to aid our understanding of complex thought processes, or a phenomenological reality, which can be experienced by all adults and possibly children. For the sake of this research project metacognition was broken down into constituents, which were then tested and measured, (see chapter 6). Whilst these four areas (metamemory, theory of mind, self as learner and mental rotation) were measured with pre- and post- tests, the tests took the form of small interviews with the children, seeking their explanations for their thinking, rather than measuring reaction times or error detection. As a result, the data collected are qualitative in nature and are then coded to produce quantitative scores. However, these quantitative scores reduce the richness of the qualitative data. A particularly important aspect that is omitted, is the opportunity to interrogate these data to seek an understanding of what meaning the children make of the questions. These questions asked them to reflect on their cognitive processing and it is important to investigate what their answers mean in terms of knowledge of, and understanding of, their own cognition. The aim of the analysis of the qualitative data from these tests is to get closer to the children's own experience of being metacognitive. In order to do this, a particular analytic method is used, which takes a phenomenological approach to the data. The method is based on the philosophy of Maurice Merleau-Ponty and was pioneered as a research method in psychology during the 1970s by psychologists at Duquesne University, most notably Wertz and Giorgi (Giorgi, 1985; Wertz, 1983)

This chapter will explain the theoretical and philosophical foundation for this approach and then go on to give a worked example of Wertz's method using some of the data from the metamemory test. The full analysis of these tests both quantitative and qualitative is given in chapter 6.

2 PHENOMENOLOGY AND METACOGNITION

As discussed in chapter 2, this project takes the view that true metacognition must be conscious or at least available to consciousness. (Brown, 1987, Baker, 1994). It is acknowledged that some monitoring and control aspects of metacognition can become automatic, but since these were once conscious they could with effort be brought back to our conscious awareness, even though this may have less than positive effects. In exploring the development of metacognition in children, we are exploring their expanding consciousness. The debates surrounding the investigation of consciousness are beyond the scope of this thesis, but one aspect of the debate is particularly significant.

Whilst scientists, psychologists and philosophers debate the nature of consciousness and how it relates to the brain, it remains that from a first person perspective we experience consciousness as affecting our lives and development.

In terms of child development theory, there is a consensus view that conscious experience of the world affects development and can shape lives and we aim to protect children from traumatic experiences for just that reason. From a third person observer's point of view it may not be apparent what effect the experience is having on the person. Similarly, a first person account of an experience omits other information available only to an observer. It seems appropriate that an exploration of children's metacognition should attempt to use methods which take account of both the child's own reports of their conscious experience of metacognition and the observer's interpretation of that experience. To concentrate on one perspective at the expense of the other would give only a partial account as Max Velmans has argued:

> "Information processing models and other third-person perspective models are incomplete in so far as they do not encompass the subject's first-person perspective. Conversely, a subject's first person account of his actions (based on what he experiences) is incomplete in so far as it does not encompass information available to an external observer. In this sense, first person and third person perspectives are complementary and mutually irreducible. A complete psychology requires both. (Velmans, 1991)p.705

First person methodologies in psychology have been criticised for their subjectivity, their lack of validity and reliability. However, Varela and Shear have addressed these issues by suggesting that:

> "exploring first person accounts is not the same as claiming that first person accounts have some kind of privileged access to experience" (Varela & Shear, 1999)p.4

and that

> "The apparent familiarity we have with subjective life must

> give way in favour of the careful examination of what it is that we can and cannot have access to, and how this distinction is not rigid but variable" (Varela & Shear, 1999)p.4

We must be careful then, to adopt methods of analysis that take account of an attempt to bracket out our own feelings of familiarity with the experience, in order to attempt to describe the experience more fully and accurately. Varela and Shear have made an important distinction between introspective psychology, which uses first person accounts and phenomenology.

> "The psychologist is motivated by research, seeks protocols and objects that can be isolated in the laboratory and also to establish empirical results that can be linked to neural correlates. The phenomenologist is interested in the same mental content in order to explore their broader meaning and place in ordinary human areas such as temporality, intersubjectivity and language".
> (Varela & Shear, 1999)p.8

This project seeks to explore the development of metacognition over one year, in young children engaged in many social and cultural experiences. The data collected are largely verbal and the exploration of metacognitive development relies upon analysis of the children's communication. It seems appropriate then, that for this part of the project, which attempts to understand how five-year-olds experience their own thinking, a phenomenological perspective may give valuable insight.

The initial search for a method of exploring the meaning of the interview data collected from the children during the administration of the four tests, (see chapters 4 and 6) led away from cognitive psychology models and towards a focus on developmental psychology. Whilst Piaget suggested that children of this age would be unable to reflect on their own cognition, developmental psychologists have since shown the extent to which, even young children, can access and talk about their own mental states, (Flavell, 2000; Kontos, 1983; Markman, 1979; Moss, 1990; Pramling, 1988; Siegler, 1996; Wertsch, 1978). Yet none of these studies has sought to describe what this is like for the child, in terms of the child's own language. A search through philosophy suggested that the phenomenology of Maurice Merleau-Ponty might shed some light on the children's experience of being metacognitive.

Merleau-Ponty sought to describe some of the mental phenomena that appeared psychopathological in terms of the known science of psychological processes. In particular, he uses a method of bracketing the known and theoretical basis for perception, in order to explore the experience of synaesthasia (where for instance, colours are experienced as sounds or shapes as tastes). His concern is to return to the experience itself and to understand it in terms of the individual who embodies it.

> "Our task will be, moreover, to rediscover phenomena, the layer of living experience through which other people and things are first given to us, the system of 'Self-others-things' as it comes into being to reawaken perception and foil its trick of allowing us to forget it as a fact and as perception in the interest of the object which it presents to us and of the rational tradition to which it gives rise. (Merleau-Ponty, 1962 p.57)

This focus on the self and the self's experiences, without regard for the theory of what something should be like, seemed to suggest a way forward for exploring the children's experience of different metacognitive factors, without overlayering their voices with theories of metacognition from either developmental or cognitive psychology. Obviously, the theory of metacognition is an adult construct of a phenomenal experience, which may or may not be experienced by children of this age. It is important to listen to the children's account of their experiences when asked to reflect upon their own thinking. Merleau-Ponty suggested that to return to things themselves, is to return to a world that precedes knowledge,

> "of which knowledge always speaks and in relation to which every scientific schematization is an abstract and derivative sign-language" (Merleau-Ponty, 1962 p.9)

As Simms suggested:

> "For the researcher to understand the world as it is constructed and lived by the child requires a suspension of our adult perceptions of what reality is" (Simms, 2001 p.7)

In this project however, the initial bracketing of this adult perception and knowledge of the theory of metacognition is later removed, in order to acknowledge the researcher's perspective on interpreting the children's experiences. This is not a naturalistic phenomenology, but one that seeks to combine first person and third person narratives to form a rich description of what it is to be metacognitive at this age and to explore how children of this age relate their cognitive processing.

The phenomenological approach of Merleau-Ponty is particularly pertinent to this project, because Merleau-Ponty developed a critique of Piaget's genetic epistemology, and sought to restore the authentic experience of the child to the rational logo-centric developmental model of Piaget. (Merleau-Ponty, 1964a). For this project, the children are on the cusp of pre-operational and concrete operational thought and thus it seems entirely appropriate that Merleau-Ponty's view of the young child as different from, but not less authentic than the older child, should inform this part of the research. For Merleau-Ponty the child's development is one of "embracing crises and regression and is not merely optimistically oriented towards the growth of rationality" (Meyer-Drawe, 1986)p.269. Furthermore, he views the achievement of the logical rational perspective characterised by formal operational thought as also involving a loss of a multi-perspectival world. Instead, Merleau-Ponty views rationality as a process of structuring the world in a meaningful way. In this sense, the explanations of the young child are not irrational, but are explanations of how they are making sense of their lived experience. For this reason, it is important to find a method of analysis, which will privilege these explanations. The aim is to see the explanations for what they are and what they say about metacognition. A method of phenomenological analysis was sought that would allow the children's experiences to emerge, without a conscious or sub-conscious comparison to a fully developed metacognition, influencing the analysis.

3 METHOD

Phenomenological method, by its very nature, differs depending on the particular type of phenomenon to be explored. Phenomenologists take the view that every new study is a starting over, where a different set of procedures may need to be followed. Phenomenology also differs from other descriptive approaches such as ethnography, grounded theory and hermeneutics. Briefly the main differences are that ethnography involves direct observation of the individual or more usually group, and participation with some of the group's activities. Ethnography involves different perspectives and a separation of description from the interpretation. Similarly, grounded theory involves the study of relationships between elements of experience, how they compare and contrast, in order to build a theory. Grounded theory takes account of both the data and gaps in the data and recognises the importance of context and social structure. Hermeneutics is probably closer than either of the above to the phenomenological approach, since it focuses on consciousness and experience. However, the main difference is that the pure hermeneutic approach seeks to unmask what is hidden behind the text. It tends to be concerned with the relationship between author, text and reader. It goes further than phenomenology in its attempts to interpret a text and takes account of historical and contextual sources. Hermeneutics has also criticised the phenomenological approach, suggesting that exploring experience with any method will distort or even create what you experience, (Varela & Shear, 1999). This is, of course, the problem with any analysis of data and there is no reason to think that it is more of a problem with a phenomenological analysis than with any other. Whilst the phenomenologist attempts to describe the experience as it is, this is always done through one lens or another, as Gallagher has pointed out. (Gallagher, 2000).

In this project, the lens is that of developmental psychology and as Varela suggested:

> ."To be sure, the exploration of experience will suffer along with all other methodical investigations from cultural expectations and instrumental bias, but there is no evidence that the phenomenal data gathered are not equally constrained by the proper reality of conscious contents. Thus whatever descriptions we can produce through first-person methods are not pure, solid 'facts' but potentially valid intersubjective items of knowledge, quasi-objects of a mental sort. No more, no less."(Varela & Shear, 1999) p.22

Within the phenomenological movement there are different methods and procedures for approaching data. The method used here is one pioneered by A. Giorgi at Duquesne University in the 1970s. It is described by Wertz (Wertz, 1983) and is used here because it works with everyday speech communication about a phenomenon and seeks a "psychological description" of that phenomenon. It also allows for different individual experiences to be combined into a group description. This seemed particularly appropriate for this part of this project, since the emphasis here, is on describing and thereby understanding what children describe and understand about their own thinking. The aim was not to focus on individual differences between the children, but to integrate their experiences into a composite description.

As Wertz points out:

> "psychological reflection and sense does not arise on a groundless base or come out of nowhere. Its point of departure is the description in everyday language of an event in the lifeworld" (Wertz, 1983)p.199.

For this project, the event to be described, is the children's explanations of how they had done the four tests of metacognition. In the example below, the test data comes from an interview, following the metamemory test with one child, (Charlotte) from School C. It was from initial readings of the interviews, following this test, that I first became aware of the need for a different method of analysis from a thematic or grounded approach. Specifically, through reading and re-reading these interviews, I became aware that whilst I was asking children about how they had done the memory task, they were often replying with descriptions and explanations of how they remember things. It became necessary then, to find a method, which would privilege these descriptions and work with them, rather than re-interpreting or re-constructing them into a theory of metamemory. Thus the data speaks of "remembering" and "memory" rather than metamemory, but by its nature, it is a child's reflection on her own cognition.

3.1 STEPS OF THE METHOD

The method used and as described by A. Giorgi, consists of four essential steps.(Giorgi, 1975) The following describes these steps and includes the explications of the method developed by Wertz (Wertz, 1983):

Step 1

The entire description is read to get a sense of the whole.

This is not as self-explanatory as it at first seems. Wertz points out that the basic stance or attitude of the researcher, during this reading process, is important. He suggests we should aim to empathise with the description before us:

> "We cannot be spectators but must experience the joys and pains of our subjects in full detail and in our very depths if we are to faithfully know them". (Wertz, 1983)p.204

This includes using the description and language used to imaginatively place oneself in the position of the respondent. It also involves slowing down and dwelling on the description, not assuming that the meaning is clear, but allowing the sense of the words to emerge in relation to each other. By slowing down and focussing on the details, the details become more important.

> "When we stop and linger with something its significance becomes magnified or amplified. What to the subject or 'naive' reader seems like a little thing becomes a big deal to the researcher. The researcher transcends the mundaneity of the subject's situation."
> (Wertz, 1983)p.205.

Step 2

The reader becomes aware of the individual's meanings.

The researcher must be interested in the way the situation appears to the individual, rather than its distance from the researcher's theoretical view point or any comparison with another perspective. In this step, the language of the individual is not changed, but units of meaning are discriminated and taken as a description of the phenomenon, (in this case 'remembering'). As Giorgi points out this assumes that psychological reality is not ready made in the world, but is constructed by the psychologist. The meaning units are discriminated through a psychological lens and thus the analysis is only one aspect of a much more complex reality.

Giorgi points out that whilst consensus between researchers can be pursued at this stage, this is not an intrinsic demand of the method. There is always an open endedness to the process. Different sorts of analysis eg. textual, literary, would lead to looking at the text in a different way. These meaning units, whilst discriminated from the whole description, are still context laden. They mark out the boundaries of the phenomenon as given by that individual. Thus, through the discrimination of meaning units, the researcher is aware of the phenomenon as different from any other phenomenon.

Step 3

The language of the meaning units is transformed into psychological language.

The transformation of the language of the meaning units into psychological language is achieved through a process of reflection and "imaginative variation". The researcher must ask "how am I understanding this phenomenon, such that this statement reveals it?" or "what does this statement reveal about the phenomenon?" (Wertz, 1983), p.207. It is necessary to reflect upon the discriminated meaning units and to include or discard the different possibilities that the meaning units present. Wertz pointed out that the description itself is not the ultimate object of reflection, "reflection ultimately addresses the subject's participation in the network of immanent significations, which make up his lived reality." [ibid. p.207]. Thus whilst the researcher reflects on the description of remembering, the ultimate aim of this reflection is to focus on the individual child's experience of remembering. The reflection should then be of the relationship between the individual and the description.

Step 4

A consistent and specific description of the phenomenon is made.

This consistent and specific description is made by synthesising the transferred meaning units. The reflection has involved a reflection on how the meaning units are related. This may be in terms of a relationship to the whole phenomenon or a relationship temporally or spatially. In making this synthesised description, the transformed meaning units are related. The researcher looks for unity and consistency and asks whether all the constituents now included in the synthesis are in fact necessary in terms of describing that individual's experience of the phenomenon. For instance the fact that Charlotte relates remembering things that happened a long time ago on the number 99 bus, is a necessary constituent of her experience of remembering, however, the number 99 bus is not, except as an example of this long term memory in process.

Steps 3 and 4 involve the transformation of language, from the individual's natural description, to the researcher's psychological language. Wertz points out:

> "The transformation into psychological language is not a mere translation into or replacement with the abstract, sedimented terms of psychology. What is involved here is original speaking on the part of the researcher. As the speaking originates from the researcher's own contact with the case, it is highly personal and specific to the case; the researcher speaks his reflection with his context of knowledge as he encounters the psychology of the case" (Wertz, 1983)p.210.

The aim is for the specific description constituted from the transformed meaning units to be consistent with the original description. Thus the researcher must ask if all elements in the specific description can be traced back to the original and if all elements of the original are present in the specific description. Giorgi makes the point that these psychological descriptions can be expressed at different levels. Thus the specific description becomes the focus of the researcher's reflection in order to make a second level, or general description. This general description again relates to the original and the specific description, but is abstracted at another level through the researcher's transformative reflection. The transformation of the individual to the general descriptive level, is not the same as the transformation between steps 2 and 3. In the latter, the movement is from everyday description to psychological description, whilst the transformation from individual to general description takes place wholly within this psychological frame. The general description is an attempt to describe what is common about the phenomenon to other cases. Wertz explains this as the structure of the psychological description of the phenomenon, which by its nature is no longer limited to the individual case.

> "Structure is a term of knowledge differentiated as such from the original individual's living from which it was extracted". [p.228]

Thus the general descriptions show how the individual descriptions are applicable beyond the original individual. However, this is not to say that they are true of all individuals.

As more than one child is involved in giving their explanations of remembering in this case, the general descriptions of remembering made for each individual child are combined to form a composite general psychological structure of remembering.

A worked example of this phenomenological approach using the qualitative data from one interview following the memory test follows.

3.2 A WORKED EXAMPLE

Charlotte (f)(Age 5yrs 8mths) School C

Memory Test

(post test data)

[For explanation of test and materials used see chapters 3 and 6]

3.2.1 The Raw Data

[R= Researcher; C=Charlotte]

1. R: [Goes through objects with child explains test] [Charlotte describes each object as she names them eg. this is a shark that catches its prey in the water etc]
2. **Observation**: [Makes characters out of objects and talks for them, plays especially with necklace. Touches each. Makes a story out of all objects]
3. C: Leaf, and the leaf is very special because when its autumn the leaves fall down
4. R: OK tell me the ones you can remember
5. C: I can remember the pirate that sails ships and boats, and I can remember lots of things I could remember the butterfly it has different kinds of colours and I can remember the snail that moves very slowly and I can remember the snake that hunts for his or her prey, I can remember the fish that swims around and lives under the sea and the shark and I can remember the shell that is

somewhere that lives under the sea that's just like floating on the sea, it doesn't really float it sinks and I could remember the insect he crawls around somewhere, I can remember the flag, that's all, and the necklace I can remember, and parrot

6. R: When I gave you a little time to remember them what did you do to remember them
7. C: Because everytime my Dad tells me to remember things I still remember it and you know something that happened on the 99 a long time ago and I still remember it
8. R: But how did you remember these objects what did you do to remember them
9. C: I remembered them by remembering my memory and playing with them so that I could hear them so I could remember them so much
10. R: OK so if somebody else wanted to remember as many as you had done what would you tell them to do
11. C: Remember their memory and if they can't they just have to try their best to remember
12. R: So
13. C: If they can't remember their one or two or ABC like they say ABD like they forgot C and they try to do it over again and they have to use their memory
14. R: Right is there anything they could do to help them remember it

15. C: To look at them very carefully and see like that's an insect, that's a spider, that's a snail

16. R: And which bit of you does the remembering

17. C: Memory

18. R: And where's your memory

19. C: My memory is in my brain

20. R: And any idea how it remembers things

21. C: It's because I was trying on the necklace and I remember the necklace I was playing with the pirate and the parrot and I was playing with the slug and the fish and like the necklace was a chain to stop the shark eating all the fishes, that's how I remember

22. R: So was it easy to do or was it difficult

23. C: It was just a little difficult

24. R: What was difficult about it

25. C: To remember all those things was a little hard

26. R: How could I have made it easier

27 C: If you just had like a little bit like one or 4, just a little bit.

Stage 2 **All constituents present in C's description**	**Stage 3** **Constituents of description expressed in terms revelatory of remembering**
1) C- describes each object as she names them – "this is a shark that catches its prey in the water", "this is the frog that hops", "this is the beautiful butterfly". She also picks each one up and looks at it before describing it.	1) C- engages with the objects, she feels them and describes them. She verbalises her thoughts about each object.
2) During observations period C turns each object into a character. She touches them and makes a story out of them. She tries the necklace on, taking great care.	2) C- turns R's memory game into a story. She makes her own game and expresses fun, curiosity and excitement.
3) C- singles out a leaf as a special thing "leaf is very special because when it's autumn the leaves fall down."	3) C- relates specialness of leaf to autumn. She expresses her remembered knowledge that leaves fall down in autumn.
4) C- lists the items she can remember using "I can remember" at start of each	4) C- goes further than listing items. She places herself at the beginning of

one and using some of the descriptions she used in 1) above. Sometimes she elaborates on a description. "I can remember the shell that is somewhere that lives under the sea that's just like floating on the sea, it doesn't float it sinks".	each object. She refers to her knowledge of her own memory "I can remember lots of things". She plays with the initial descriptions, elaborating and adding information from stored knowledge about the properties of a shell.
5) C- refers to her Dad, "everytime my Dad tells me to remember things I still remember it".	5) C- refers to parental figure as a function of her memory.
6) C- remembers things that happened a long time ago on the 99.	6) C- displays long term memory. This is rooted in being present at the time of the event.
7) C- "I remembered them by remembering my memory and playing with them so that I could hear them, so I could remember so much"	7) Remembering is connected to memory. C explains strategies for remembering. Playing with the objects allows her to hear them, this makes for greater recall.

8) Others must "remember their memory" to be successful. Also to "look very carefully" and "see like that's an insect"	8) Looking and seeing, paying attention to what the objects are is important for remembering
9) C- "my memory is in my brain"	9) Memory is located in the brain
10) Difficult to remember so many, "Just a little bit would be easier".	10) Shows awareness of capacity of memory. Fewer objects would be easier to remember.

Step 4

3.2.2 Specific description of situated structure of remembering

Charlotte engages with the objects fully. She feels them individually. She describes each, making distinctions between them. Then she turns them into characters, speaking for them and changing her voice to suit the character. She turns my game into her story. She appears fully engaged in the story she made and expresses fun, curiosity and excitement. She becomes aware of my presence again and tells me what she perceives as the special quality of one object (the leaf). In recalling the items she sets up a mantra and describes each item to me as she had earlier done to herself. She adds information about the object as it comes to mind and elaborates on the descriptions. She refers to a parental figure and being told to remember things. She displays a long term memory, which is rooted in being present at an event. Charlotte connects the act of remembering to her memory, which she locates in her brain. Playing with the objects, making them into characters with a voice has allowed her to remember them, because she can hear them. Other people would do well to pay attention and look carefully in order to see what the objects are; this will help them to remember. The number of objects affects recall. Fewer objects would be easier to remember. Charlotte shows an awareness of the capacity of memory and one variable (no. of items) which will effect successful performance.

Step 4 level 2

3.2.3 General description of remembering

Remembering a large number of objects necessitates becoming fully involved with them. Making distinctions between them and paying attention to their essential qualities will help. When told to remember something it is possible to do so. Long term memory is connected to being present at the time of the event to be remembered. Remembering is connected to memory, which is located in the brain. Memory has a limited capacity. One variable that will affect memory performance is the number of objects to be remembered.

This method was used to provide general descriptions of remembering for all the children who took the pre and post tests.

Following the general descriptions, a composite description for the whole group is made. The following is a composite description based on general descriptions for the experimental group of which Charlotte was a member at post test.

3.2.4 Composite general psychological structure of remembering (experimental post test group)

When children of six years speak of remembering freely, they refer most often to long-term memories. These are given as stories of situations and events at which they were physically present and which have some essential meaning for themselves. The stories can be related in great detail and often include the feelings of the participants as the events unfold. Relating these stories from long term memory appears natural, they are often accompanied with physical gestures and are told with energy and enthusiasm. There is a tension apparent between this free remembering and reflected thought on remembering (or metamemory). However, children of this age are also able to reflect on processes and strategies that accompany remembering.

Remembering can be linked to knowledge, to retrieval of stored facts. "I know snakes are poisonous, I remembered it". This is the type of remembering that is dictated by adults, especially in educational settings. Remembering is linked to learning, but it is not the same thing. Children of this age can make this distinction in the sense of we can learn by watching others, but we cannot remember that way. Remembering is different too, from other things we learn, such as reading and writing. Strategies that help us in reading and writing do not help in remembering.

To remember things you need to think. Thinking and remembering take place in the brain, but they are not the same thing. Remembering is performed by the memory, and thinking about things or concentrating on them allows those things to enter memory and be stored there until they are needed, when thinking about them again will bring them out again. Remembering is both an internal and a physical act, there is a mystery to how the things to be remembered enter memory, but once there they are real. The memory store is limited and some things have to be deleted to make room for new things.

Memory is located in the brain, or in the head. The brain is a control centre for the body, it is different to the heart. But the brain is physical, it requires "warming up" or "exercise" before it begins to work and something inside the brain starts it working. The brain is fallible, it can get things wrong and it can find things difficult. Remembering is not easy and knowing that you have forgotten something brings about an emotional experience, it makes you feel sad and uneasy.

Remembering a lot of objects requires that you first get to know them. The sense of sight and touch enable the remembering. Concentration and focus on what the objects actually are or represent means that you can then name them and repeat naming aloud or to oneself will help you to remember them. The first objects to be named will be the first to be remembered.

It is easier to remember things if you use a strategy, but not all strategies are good. Making stories from the objects and giving voice to the characters in them will enable recall of the characters' voices and thus the objects. Making order out of the objects either as a pattern or a group (the groups should refer to real-life) is a good strategy, as is rearranging the objects in alphabetical order. Counting, closing your eyes or writing a list are all good strategies.

The type of objects to be remembered is important. Consistency of size and objects that are similar are easier to remember.

4 DISCUSSION

This chapter has described a method of phenomenological analysis, which attempts to clarify what it means to be metacognitive at the age of five or six years old. A phenomenological approach has been necessary because it is unclear what metacognition is for this age group, or even whether children of this age can be metacognitive. Metacognition, like all reflective aspects of consciousness is difficult to observe in everyday experience. Braddock makes this point:

> "As emphasised by Husserl and Merleau-Ponty the object-directedness of consciousness makes it difficult for the conscious subject to focus attention on the nature of conscious states themselves without becoming lost in the objects of these states"
> (Braddock, 2001) p.2

The metamemory test carried out as an interview makes just these demands of the children. Thus the data it produces are not, as far as we know, everyday data of the child's life. It is unlikely, though not impossible, that children of this age spend much time reflecting on their memory or how they remember things. However, when asked to do so, they are quite capable of reflecting in this way. They don't, for instance, confuse remembering with any other cognitive process, nor do they have a problem with suggesting how their memory works. That they respond to these questions with answers that do not fit readily into cognitive psychological models of how memory works, reflects their own experience and understanding of their own memory, rather than a learned response of how their memory should function.

The phenomenological method of analysis is sensitive to this personal experience. It involves the researcher in actively putting to the side all notions of what metamemory is, or what a reflection on remembering is, in order to make clear what the children say about these processes. Whilst it is impossible to completely eradicate a knowledge of the theory of metacognition during the phenomenological analysis, it is sufficient, as Merleau-Ponty said to "slacken the intentional threads which attach us to the world and thus bring them to our notice" (Merleau-Ponty, 1962)p.13

The pursuit of a phenomenological approach with children is firstly, a vicarious experience. The phenomenological method used here involves the researcher in a process of imaginative variation in firstly discriminating meaning units from the initial communication and then reflecting on those, in terms of their intentionality towards the phenomenon, characterised here, as remembering.

The imaginative variation has helped to clarify the essence of metamemory for children of this age. Charlotte has told us something of her personal experiences of her memory. These are described in terms of physical events, such as being on the 99 bus, or as relational, in terms of her circular connection of father-memory-self.

Metamemory, the ability to reflect upon one's memory tends towards relationships and events. Whilst the cognitive model of metamemory remains an abstract, this phenomenological analysis has shown that the experience of being metacognitive at this age, necessitates thinking about real experiences. The phenomenological analysis has had the effect of transforming the abstract theory of metamemory back to its essence as a lived experience. In this way, this type of analysis has made the link between the cognitive psychological concept of metamemory as a constituent of metacognition and the phenomenological experience of what it is to be metacognitive at this age. Through the process of imaginative variation we now see that metamemory is a reflection on different constituents such as the memory as an object or remembering as a process.

It is clear from the composite general description of remembering above, that children of this age can experience themselves as cognitive beings and can reflect on their own cognition when asked to do so. They can distinguish cognition from action and yet make the intentional link between cognition, emotion and sensory experience. This suggests that they are resisting the Cartesian split of mind and body. These more general issues are returned to in chapter 10. However, this analysis would suggest that there may be something we can call a pre-formal operational metacognition, which is embodied and intuitively employed when necessary. It may be this intuitive metacognition, which is being brought to light by the phenomenological analysis of an intentionally directed cognition. To clarify, asking children to firstly undertake a memory task and secondly to reflect on how they did it, involves them bringing their intuitive metacognition to consciousness.

The adoption of a phenomenological approach to the data from the four tests aimed to clarify what it is to be metacognitive at the age of five or six years old. Completing this type of analysis has also involved a reflection on first and third person methodologies and the problems associated with each. The phenomenological approach was used to maintain the richness of the children's explanations, which would otherwise be lost in the purely quantified results examining change in metacognition over the year. However, the approach has also clarified the way children reflect on their own thinking. It suggests what metacognition is for this age group and the ideas and themes revealed by this analysis will be taken up in future chapters. In particular, this new understanding will guide the analysis of classroom observations of children's metacognition, (see chapters 7 and 8). In this way the phenomenological method which has allowed a return from theory to lived experience will guide the understanding of both teachers' facilitation of metacognition and children's metacognitive behaviour. A phenomenological analysis is, by its nature never completed, but for this project the analysis carried out on all the test data, (see chapter 6), begins to clarify the elements of metacognition and to describe them in terms of their meaning for children of this age group.

The next chapter presents the four tests of metacognition in full and gives both the quantitative results of these tests and the phenomenological descriptions produced from the qualitative data for each test using the above method.

Chapter 6

FOUR TESTS OF METACOGNITIVE FACTORS

1 INTRODUCTION

This chapter provides data and analyses for four tests of metacognitive factors administered individually to 24 children from the experimental schools and 18 children from the control schools at the beginning of the intervention year (September 1999). The tests were repeated with 21 of the 24 original children from the experimental schools and 16 of the original children from the control schools at the end of the intervention year (July 2000). Results are thus given for 21 children from the experimental schools and 16 children from the control schools.

The pre/post test design of this part of the research project seeks to address the first two broad research questions:

1. Can metacognitive ability be enhanced ?
2. Are metacognitive gains related to cognitive/academic gains ?

As described in chapter 3, these two broad questions include the more specific research questions of:

1a) How is metacognition conceptualised for this research ?
 b) What is metacognition for five to six year olds ?
 c) How can metacognition be measured ?
 d) Does CASE@KS1 as implemented impact on any factors of metacognition ?

and

2 a) What are cognitive gains for this project ?
 b) What are academic gains for this project ?
 c) To what extent are these measurements clouded by other variables?

Firstly, the data from the four tests used is analysed quantitatively using specific scoring systems for each test. In order to test the hypothesis that CASE@KS1 has an effect on metacognitive development, gains were calculated by subtracting the pre-test score from the post test score for the self as learner test, the metamemory test and the mental rotation test. Pre- test data was missing from the second theory of mind test and the first test reached ceiling at pre-test. The gain scores were subjected to chi square tests and the results are given separately for each test. Spearman rank correlation was also carried out to test the correlation between all four tests; to test for correlation between these tests and the CASE@KS1 drawing and conservation tests and between these tests and end of year 2 national tests in language and numeracy. The data were also subject to a phenomenological analysis to elicit deeper meanings.

Three major problems occur when undertaking a test based method and analysis such as this one:

1) The reliability of the tests
2) The use of verbal reports as data for psychological processes
3) The use of test data for phenomenological analysis

Problem one will be discussed under each individual test section

Problems two and three are more general and are addressed below :

2 VERBAL REPORTS AS DATA

The problem here is both a philosophical one and a practical one. Philosophically, relying on a child's responses to questions to display a revelation of their thinking processes presupposes a notion of a relatively stable system of cognitive representations. It also suggests that children's verbal reports about psychological processes are a direct link to their thoughts, or that the thoughts about their own thinking processes exist prior to them being asked about them. In other words, children hold some concepts about their own thinking processes, which can be elicited by careful questioning. Alternatively, it could be that children's answers to questions about their thinking show how they are "able to think, given novel problems that they may never before have thought about", (Edwards, 1993).

However, it is also possible as Estes says that:

> "The novelty with which children speak about thought processes leads some to conclude that young children have an ability to report and discuss their mental activity including an ability to "reflect on and transform mental images", and that this ability is not simply a learned discourse, based on consensual theories about cognition" (Estes et al., 1989) (pp84-5).

The evidence presented below from this study would seem to support this latter view. It is equally important to bear in mind the theories from linguists and ethnographers such as Edwards and Mercer (1987); Edwards, (1989); (Potter & Wetherell, (1987) and the work of Mead, (1934),which show us language as action and language as situated discourse. These theories suggest that any discourse including cognitive tests such as those below cannot be decontexualised, but must be seen as situated, culturally, historically and linguistically. When asked to speak of thought processes, children, whilst using seemingly novel language, are still appropriating concepts of thinking that are culturally given. Verbal reports of psychological processes of either children or adults must be treated with caution.

The following data provides a snap shot of children's verbal responses to questioning about thought processes, further analysis is undertaken through a phenomenological approach to attempt some clarity of the children's responses. However, this qualitative analysis does not address the situated nature of the discourse. In later chapters verbal data is subject to a case study analysis to seek understanding of how these novel descriptions of cognitive processes and their underlying phenomenological meanings may be constructed through situated discourse, (see chapter 8).

3 THE USE OF TEST DATA FOR PHENOMENOLOGICAL ANALYSIS

As described in chapter 5, phenomenology is primarily concerned with embodied experience. This means both in what way am I conscious of my body and in what way does my body experience the world. Traditional phenomenological analysis has relied on first person data gathered from a single question or topic. In contrast, this study uses data from test conditions. It may be that children are far more aware of and involved with their own physicality than adults are. However, it is interesting to note how many children during the testing spoke of physical aspects of their body, either in response to specific questions about their thinking, or more generally in asides as they worked on the test materials.

Rather than viewing metacognition as a whole, the four tests were designed to elicit children's understandings of separate factors of metacognition, the metacognitive aspect being their stored knowledge of and ability to reflect on the particular cognitive process under investigation. Gallagher makes the point that

> "Even when evidence is gathered in abstract or experimental situations we should try to keep in mind the way it can be cashed out in pragmatic

and socially contextualised situations" (Gallagher, 2000)p.3

Gallagher goes on to suggest that triangulation of methods is necessary to understand something as complex as cognition:

> "To understand something like cognition or
> embodied experience we need to use neuroscience
> and psychology as well as phenomenology" (Gallagher, 2000)p.2

This study uses triangulation of analyses. Undertaking a phenomenological analysis of the test data is one aspect of the analytical process, the quantitative results are another and the third, found in later chapters, is a situated content analysis. These three approaches are reflected in the tripartite nature of the study with tests, observations and interviews and in the contexts of researcher-child, child(ren)-child(ren), and teacher-child(ren) interactions. Gallagher's approach to phenomenological analysis of cognitive data cautions against generalisations

> "we should not assume that conclusions drawn in
> one domain will necessarily generalise across all
> domains of cognition. Rather we should assume
> domain specificity until the evidence is sufficient
> for making a more generalised claim" (Gallagher, 2000)p.2.

The four tests of metacognition described below assume an initial domain specificity for each area. Only when all the data is analysed will any more general conclusions be drawn, (see chapter 10).

4. THE TESTS

4.1 SELF AS LEARNER

4.1.1 Introduction

This test was designed to elicit a dialogue about the self as a developing cognitive being. It is based upon Flavell's theory of the person category of metacognitive knowledge, (Flavell, 1979). It brings together knowledge of how one learns and a more fundamental concept of knowledge; which is that the knowledge one possesses at a given time has been learned and the individual existed before this knowledge was embodied. The test was designed also to be an ice-breaker, a test of counting that all the participants would be able to do with or without help. It was important to begin with something seemingly simple to achieve, so that the focus would be on the ensuing discourse, rather than the counting. It was also a relatively short test, which would allow for familiarity with the recording equipment and other social factors to be established before the more complex tasks.

One characteristic of all four tests was to provide stimulus material and a secure environment for children to speak about their own thought processes.

4.1.2 The Test

The pre-test was conducted on an individual basis, with the researcher and child seated at a table away from the classroom environment. In some schools the test was conducted in the library, in others in a corner of a quiet corridor. The test was audio-taped and field notes taken. Five red plastic cubes were placed on the table and the child was asked to count them. This was facilitated by the researcher sometimes joining in the counting, but most often the child did this unaided and appeared comfortable with the task. Then the following questions were asked:

1) How did you learn to count?
2) Was there a time when you couldn't count?
3) (if yes) when was that?
4) (if no) have you always been able to count?
5) What is the difference between you then before you could count and you now?

Then the interview was extended to talk about letters of the alphabet with

1) Do you know some letters of the alphabet?
2) Was there a time when you didn't know the letters?
3) What is the difference between you then and you now?
4) How did you learn the letters you know?

Post Test

The post test at the end of the intervention year was undertaken in the same way. The only difference was that shapes were used rather than counting cubes. The questions were then :

1) Have you always been able to make patterns from shapes?
2) Was there a time when you couldn't do this?
3) What is the difference between you now and you then?

4) How did you learn to do this?

The post test differed from the pre-test to try and ensure that the replies given were not just copied memories from the pre-test. However, the post test was sufficiently similar, to ensure that the results of both tests were comparable.

4.1.3 Scoring

Codes:

A – Say there was a time when couldn't count/know letters/make patterns

B – Credit learning to externals – mother/ school/ siblings etc.

C – Mention self-learning strategies – practising, working it out etc.

D – Say they've always known

A combination of code A + C was scored as 1 (ie was taken as an indication of metacognitive processing)

All other combinations were scored as 0

The reduction of the data into a dichotomous scoring system was done to focus the results on the difference between children who were showing some metacognition and those who were not. Whilst this reduction may result in a loss of some qualitative data at this stage, this is later remedied by the phenomenological analysis.

A score of 1 indicates that the child has said that there was a time before s/he could count, know letters or make patterns <u>and</u> has mentioned one or more self-learning strategies. The combination of these two categories is important in terms of metacognition. Firstly, confirmation of there being a time before one could count indicates a view of counting as a developmental experience. It is not something that one is born knowing how to do. Secondly, the mention of any self-learning strategy indicates a view that an individual learns these things by some means. Certainly adults may assist, as do books, but neither the adults nor the books actually do the learning for you. A child scoring 1 on this test is, in my view, indicating some understanding of the learning process. Viewing oneself as a learner is a reflective act, a metacognitive act. Whilst the answers to my questions are probably constructed at the time and may not reflect "stable, statable knowledge" (Brown, 1987), they do indicate that whilst some children, when asked to think about the learning process, show a metacognitive awareness, others view learned behaviours quite differently. Occasionally a child will say that they had always been able to count etc. even when a baby:

School Z – James (post test)

R: OK now if I'd asked you to do this when you were very small would you have been able to do it?

J: Yes

R: Was there a time when you couldn't do it?

J: No

As the questions went on I sensed that maybe James did not understand the question, because I had inadvertently complicated it and so I tried to simplify it again:

R: So is it something you learnt how to do?

J: No I didn't learn it, I just done it

And

School D – Alan (pre-test)

After saying he has always been able to count

R: was there a time when you didn't know the alphabet?

A: I still know them when I didn't know

R: You've always known them, even when you were very small, you knew the letters?

A: Actually when I was three I still know them, when I was two I still know them, when I was one I still know them

Sometimes the children scored 0 because although they said they had learned how to count when questioned further they put this down to either age alone or some physical property, for instance:

School Y – Sara (pre-test)

R: How come you can count now and you couldn't when you were three?

S: Because I'm bigger

And

School D – Paul (post test)

R: you didn't know how to do it then [when a baby]?

P: cos I didn't have teeth and I couldn't talk

And

School Z – Hera (pre-test)

R: how did you learn the letters?

S: with my mouth

More often the children put the change from not being able to count, or know the alphabet, to being able to, down to their mother, sibling or teacher eg.

School Y – Jacob (post test)

R: Did you have to do anything to learn how to do it?

J: The teacher told us to do our work how she wanted us

R: Who does the learning you or the teacher?

J: Teacher

However, this could also be interpreted as a language confusion, common to children ie. the difference between the words "teach" and "learn". Yet as the interview went on there was no other explanation forthcoming and so this was scored as 0.

4.1.4 Results

Experimental schools *n=21*

Control schools *n=16*

Scores were totalled for each group, converted into percentages and plotted as bar charts.

Figure 6.1

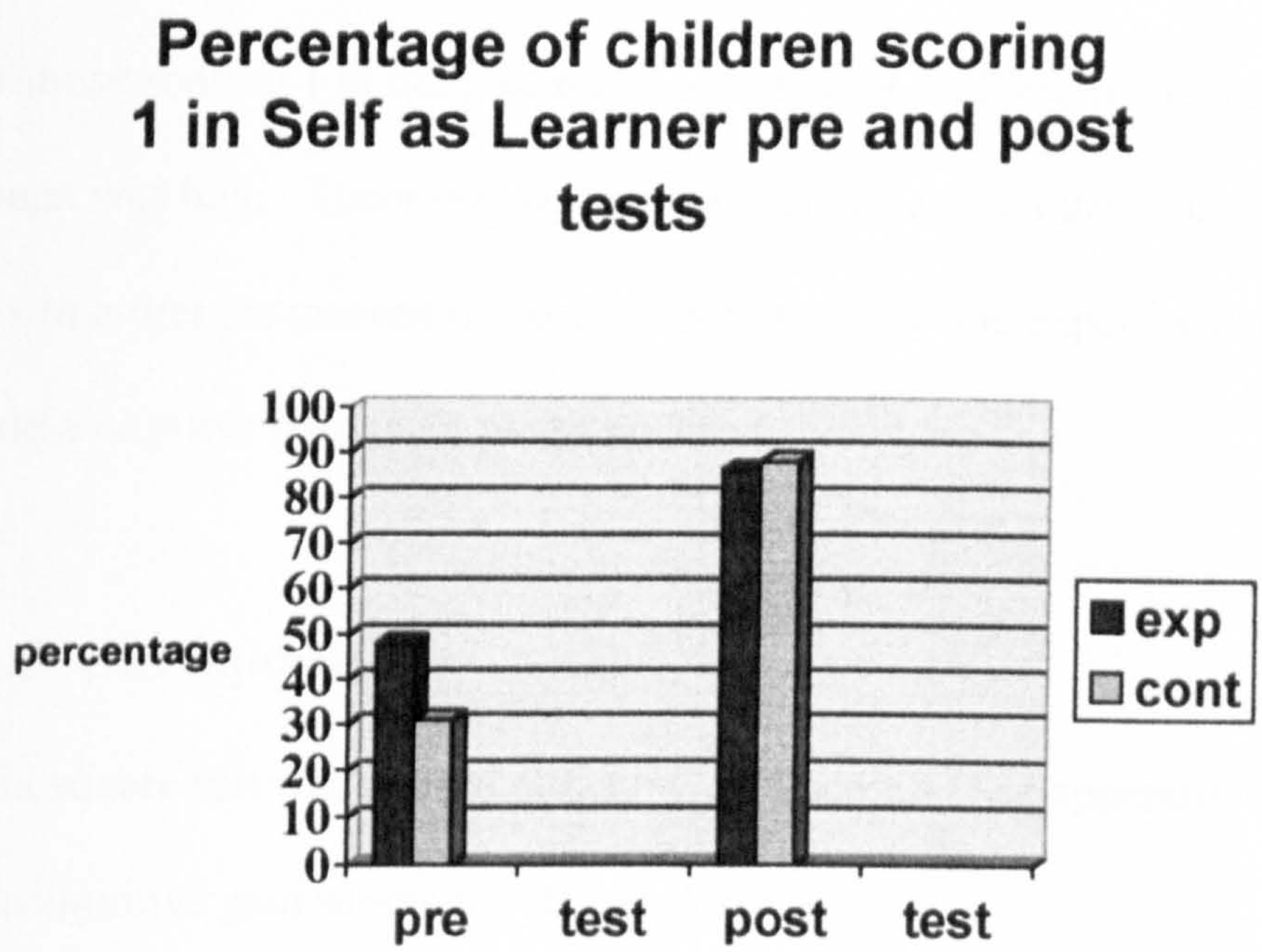
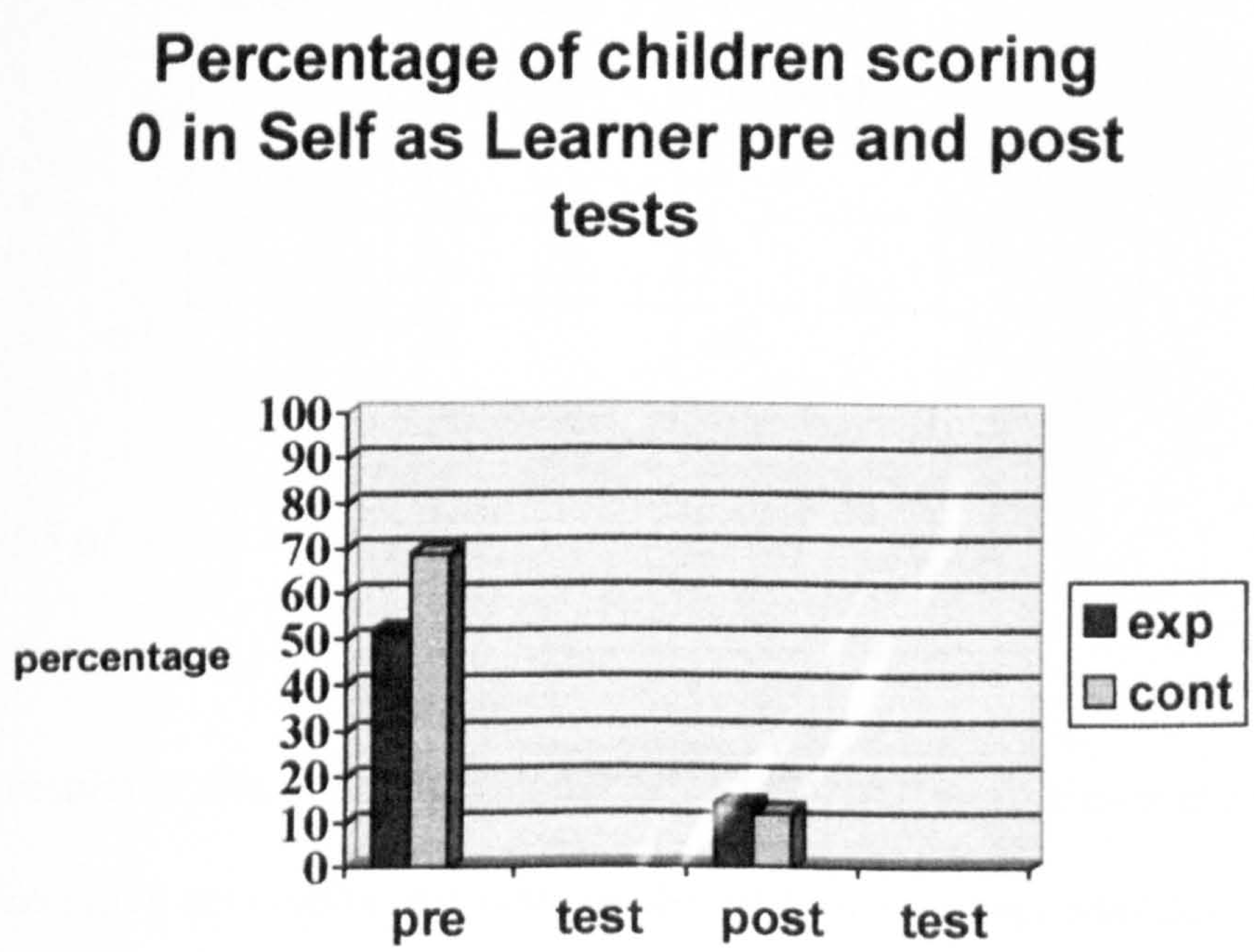


Figure 6.2



The quantitative data show little difference in the pre-test scores between the experimental and control groups. At post test the scores were even closer together. For those scoring 1 at the post test the scores for both experimental and control groups was high. There was no real difference between the scores of boys and girls in either the pre-test or post test results. Only one experimental school child made a negative gain from pre to post test.

4.1.5 Chi Square

A chi square test was carried out using gain scores. (See appendix 6 for metacognitive gain scores for all four tests).

Table 6.1 Self As Learner (observed frequencies)

score	no of exp children	no of cont children	
-1, 0	12	7	19
1	9	9	18
	21	16	37

$\chi^2 = 65$ df = 1 ns

4.1.6 Summary

The results of this one item suggest that as children mature over the year (age 5 to 6 years) they become more aware of themselves as beings who develop and learn. This is also the first year of formal schooling (discounting the reception class which can still be classed as a relatively more pre-school environment). The enculturation of school no doubt plays a great part in this developing awareness, as teachers were observed making frequent references to learning during the school day. Parents too, probably reinforce this as they ask their children about what they learnt at school that day. (No evidence was gathered about parental influence in this study as it was outside of the parameters of access negotiated by the main CASE@KS1 project).

The results of the chi square show that the specific intervention of CASE@KS1 had no greater influence on this developmental process than does the normal primary school learning environment and maturation.

4.1.7 Phenomenological Analysis

The test did, however, show some interesting ideas expressed by the children, about the process of learning and development. The answers to my questions given by each child, were subject to a phenomenological analysis following the pattern described in chapter 5.

This approach sought to answer the following question: *What do children of five to six years old know about the process of learning?*

Since the quantitative results showed no real difference between the control and experimental group scores, the general descriptions of both experimental and control group were combined to give one composite general description of learning for those scoring 0 and one general composite description of learning at for those scoring 1. Originally pre and post test data were analysed separately. However, children scoring 1 at pre-test and those scoring 1 at post test differed only slightly in terms of sophistication. Thus the pre and post test general descriptions were combined to form a composite general description of knowledge of learning from children scoring 0 and a composite general description of knowledge of learning from children scoring 1. The slight differences between the pre- and post test descriptions for those scoring 1 can be seen as consistent with further development of the nature of learning.

Composite general description of the knowledge of learning ,from interviews with children who score 0 on the Self as Learner test (experimental and control groups combined)

For the children who scored 0 on this test learning is not a process, but fixed in time. There is no difference between being a baby and being five, except in terms of physical growth. Babies can't talk and don't have teeth. But for themselves as individuals, they have always known what they know now. They can acknowledge the help of others, but see this as others telling them things and then they know how to do something. They acquire knowledge by being told by someone older. They play no active part in learning. Learning to count is described only by the physical actions used ie. counting with hands or fingers. Mouths and teeth are important in learning, but this is not extended to understanding language. Physical characteristics distinguish themselves now from their pre-verbal selves, themselves as babies. Yet, often these children maintain that they still knew how to count before they developed these physical characteristics. Most notable in the explanations of this group, are the references to physical growth and physicality in general, in relation to knowledge. Knowledge is transferred from a significant adult to the child by some direct means, without the child having to do anything themselves. Some children stress that no one helped them to do things and that they could always do them. Often the children in this group were unwilling, or unable to express their ideas on the topic. Don't know was a frequent response.

Composite general description of the knowledge of learning from interviews with children who score 1 on the Self as Learner test (experimental and control groups combined)

At the beginning of the year about half of all the children tested showed some awareness of themselves as learners. Learning is linked to getting bigger physically and to maturity – getting older. Babies are too small to learn. The difference between themselves now and themselves as babies is that now they can talk. Language is an important factor for learning. They had learned how to do things and five year olds are different from two and three year olds in the amount of things they can do. They learn things at home or at school. Other people have been important in this process, mothers, siblings and teachers have all helped the five year old to learn, but they don't do the learning for you. Sometimes other things help you to learn, such as books and television. People also learn by thinking and working things out. Using fingers can help people learn how to count. They know more now than they did when they were two or three because they have learned things.

By the end of the year over 80% of all the children tested had some awareness of themselves as learners and showed a growing sophistication of the process. Learning is still related to growth and age but also to physical activity. Babies only sleep, whereas six year olds do things. They use their minds to think and to work things out. Practising helps you to remember how to do something. Practising makes you get better at doing something. Learning is an active process, which involves using your head. To learn things you have to do them. Other people can help by showing you and you can copy what they do, but you have to practice and do things over and over again to learn them. Parents, siblings and teachers can help you to learn but you have to listen and pay attention to what they say. Teachers can tell you things but you still have to do it for yourself in order to learn it. Talking is important for learning because you need to ask questions if you don't understand and if you can't talk, you can't understand the instructions of what to do. Babies can't understand some things, so they can't learn them. You can learn by watching people, but you have to try things out for yourself. Sometimes you can learn things on your own by working problems out in your mind and thinking about them very hard. You can also learn by playing with toys. You can learn to do a new thing because it is similar to something you have done before, for instance you can learn about sorting from sorting out Christmas presents. You know you have learnt something when you can do it for yourself. Learning things means that you get smarter.

4.1.8 Discussion

Language development may be an issue with the responses of the children scoring 0. As previously mentioned, there may be some confusion between teaching and learning, for instance when a child says "the teacher does the learning". However, these same children were able to speak more clearly and precisely about memory and remembering in the metamemory test (see below). The few children scoring 0 at the end of the year often seemed reluctant to answer the questions, "don't know" was a frequent response, yet again, these same children gave much fuller answers to the memory test. Thus, either the questions on this test were causing confusion, or what seems more likely, since the questions were as similar as possible throughout the tests, is that the notion of learning as a process is less easy to grasp, than that of remembering. The reluctance at the end of the year to answer the questions on this test may indicate that these children were at a point of transition in their understanding of learning as a cognitive process. They had just about given up their pre-test ideas about not having to learn something but always knowing how to do it, but had not yet fully formulated their ideas about how they learned something, to be confident enough to convey it to me. Just as learning itself is developmental, so at the meta-level, an understanding of the idea of learning requires a certain maturity and sophistication of thought. Learning is also tied much more closely to education and school than is remembering and as such one is probably less immediately conscious of learning until one has experienced the very specific learning culture of the classroom. This will take longer with some children than others depending on variables such as home background, language development and external social forces. It is interesting to note that although the self as learner test preceded the metamemory test some of the children scoring 1 on the post test linked learning to remembering, whereas none of the those scoring 0 mentioned any other thought process.

The references to physicality throughout the pre-tests suggest a certain developmental stage, one in which the reality of the physical body is predominate in a child's thinking. Whilst the references to physical attributes remain a year later, they are now enhanced with a growing awareness of cognitive processes. For those children scoring 1 at the end of the year physical traits are not the only differences between themselves now and themselves as babies, just as their bodies have grown, so has their ability to think and reason.

An understanding of oneself as a learner appears to be a general developmental process which was unaffected by the intervention of a cognitive acceleration programme. However, self as learner is only one factor of Flavell's theory of metacognition. Results of the tests of other factors are below.

4.2 THEORY OF MIND

4.2.1 Introduction

As discussed in chapter 2, theory of mind involves the ability to consider another's point of view. A lack of this ability causes problems for both social and cognitive domains and as evidenced from work on autism, this lack of a developed theory of mind is viewed as a disability. The definitions of Theory of Mind have broadened since the early experiments with apes by primatologists, (Premack & Woodruff, 1978) and the false belief experiments of cognitive scientists such as Wimmer and Perner (Wimmer & Perner, 1983). More recently, theory of mind has been conceptualised as social knowledge by Tager-Flusberg and Sullivan (Tager-Flusberg & Sullivan, 2000). Their componential model suggests that theory of mind has both cognitive and perceptual components and that a distinction can be made between immediate judgements of mental states (perceptual) and the ability to make more complex judgements (cognitive). A basic understanding of others as cognitive beings is generally accepted to be in place at around three years of age and by four, children are generally able to pass false belief tests, such as those replicated in this study. However, it is also generally accepted that theory of mind continues to develop, becoming more sophisticated and allowing for the development of understanding intentions and morality. Whilst the social-perceptual aspect of theory of mind is thought to develop earlier than the social-cognitive aspect, both are considered to continue to develop through childhood. (Tager-Flusberg & Sullivan, 2000)

For this project, theory of mind is conceptualised as a parallel to Flavell's "knowledge of others" component of his model of metacognition. (Flavell, 1979). It is deemed important for both social and cognitive development. An awareness of how others view a problem may help to develop an understanding of problem solving strategies in general. The ability to work with others on any task requires an understanding of differences and similarities between self and others.

The false belief task has been used many times to assess the developmental age of the emergence of an understanding about the self and others as cognitive beings. However, in the mid 90's Carpendale and Chandler suggested that false belief tests were limited in what they tested and that success on these tests did not demonstrate an understanding of mental life as constructed or interpreted. They argue that standard false belief tests "are only about the recognition that people who are poorly informed are entitled to their own ignorant beliefs" (Carpendale & Chandler, 1996)p.1686.

In order to test for knowledge of an interpretative theory of mind, which is a more metacognitive construct than is an understanding of false-belief alone, Carpendale and Chandler devised a number of tests around the premise that one stimulus can be interpreted in more than one way. Success on this kind of test would give an indication of the stage of development of an interpretative or constructivist theory of mind. Carpendale and Chandler argue that whilst other theorists do suggest that success on false belief tests is not evidence of a fully formed theory of mind they conclude that:

> "whatever differences they [other theorists eg. Perner, Wellman, Flavell] do imagine still divide the 4 year olds' and the adults understanding of mind [these] continue to be taken as primarily quantitative and skill driven, rather than qualitative"
> (Carpendale & Chandler, 1996)p.1687

This distinction, the stress placed on the qualitative difference between a four year old's theory of mind and that of an adult, convinced me that for this project a false-belief test alone would not be enough. The age of the children, (5-6 years), suggested that they would all pass the standard test and this would tell me little about their developing theory of mind and whether by the end of the year the CASE intervention had had any effect on it.

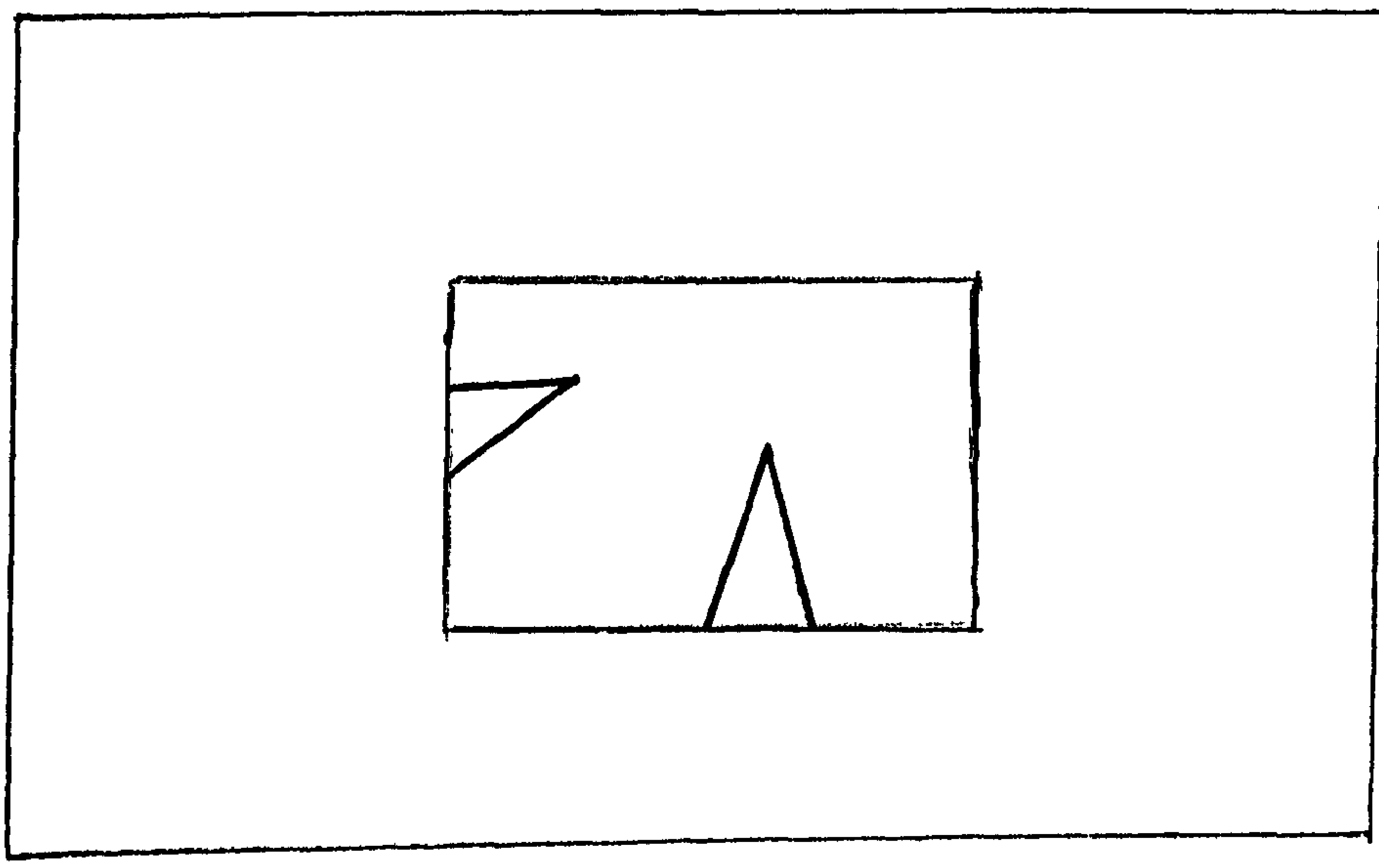
4.2.2 The Tests

Test 1 administered to 24 children from the experimental schools and 18 children from the control schools was the standard Perner Smartie tube test of false belief, (Perner, Leekam, & Wimmer, 1987)[See chapter 3]. This test was given only at the start of the intervention year. Since all the children were successful on this test, as predicted by developmental theory, there seemed no need to repeat this test at the end of the year. The second test was in two parts and aimed to assess the children's developing interpretative theory of mind. This test was only administered at the end of the intervention year to 21 children from the experimental schools and 16 children from the control schools. Comparisons can be made between the control school children and the experimental school children, since the two groups reflected the make up of the sample for the whole project and were therefore as matched as possible at the start of the year. The test was adapted from one used by Chandler and Helm (Chandler & Helm, 1984)

Part one consisted of two cartoon drawings. These took the form of "droodles" (Price, 1953) or cryptic line drawings, [See Fig 6.3 and 6.4 below]. These were the same ones used by Chandler and Helm. Drawing one consisted of two triangles pointing inwards from the side and bottom border of a rectangular frame. The title of the picture is "A ship coming to save a drowning witch". There is obviously no way anyone could guess this title from the triangles. However once the title is given, it is hard to see the drawing as anything else. Following Chandler and Helm, the first stimulus for this test was the witch and ship droodle, but with the full picture of the ship sailing towards a drowning witch drawn out and an overlay with a square viewing window cut out so that the droodle alone could be seen. The second picture to be used was a droodle entitled "Two elephants sniffing a grapefruit". This droodle was also presented as both the full drawing and the drawing with an overlay and a square viewing window cut out. (See below).

Figure 6.3 "Droodle" – "A ship coming to save a drowning witch"

a) The cut out overlay



b) The full picture

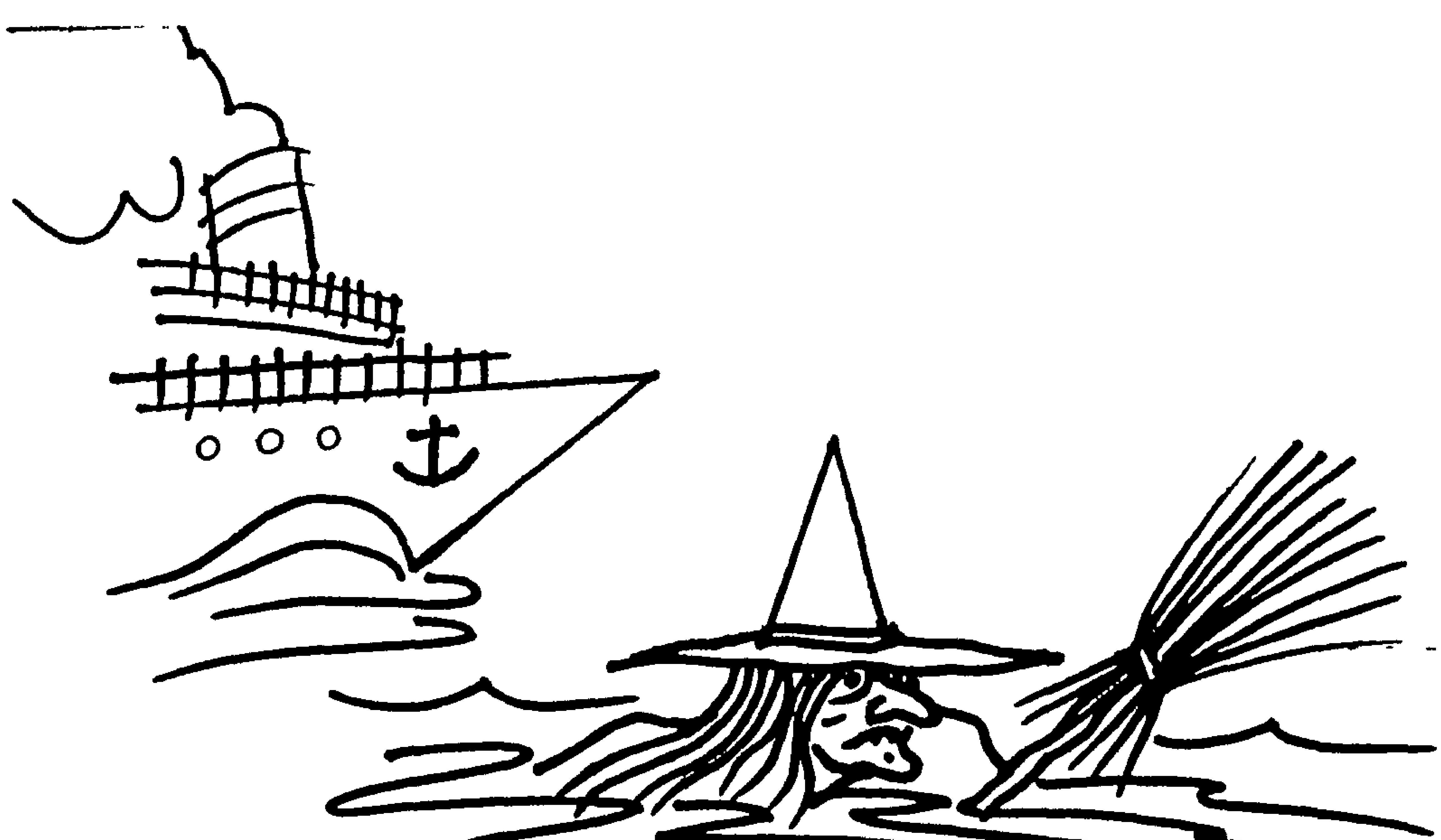
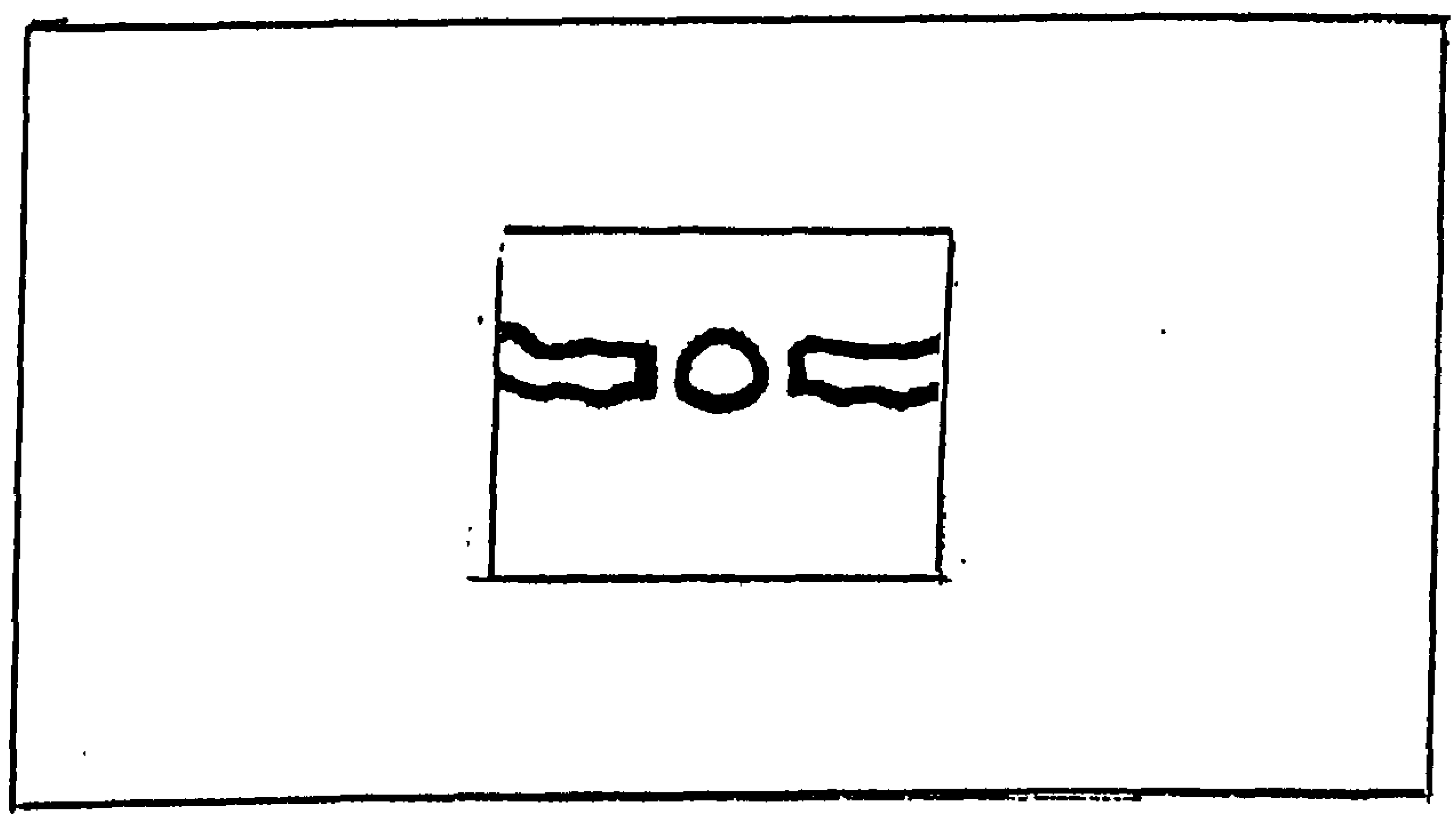
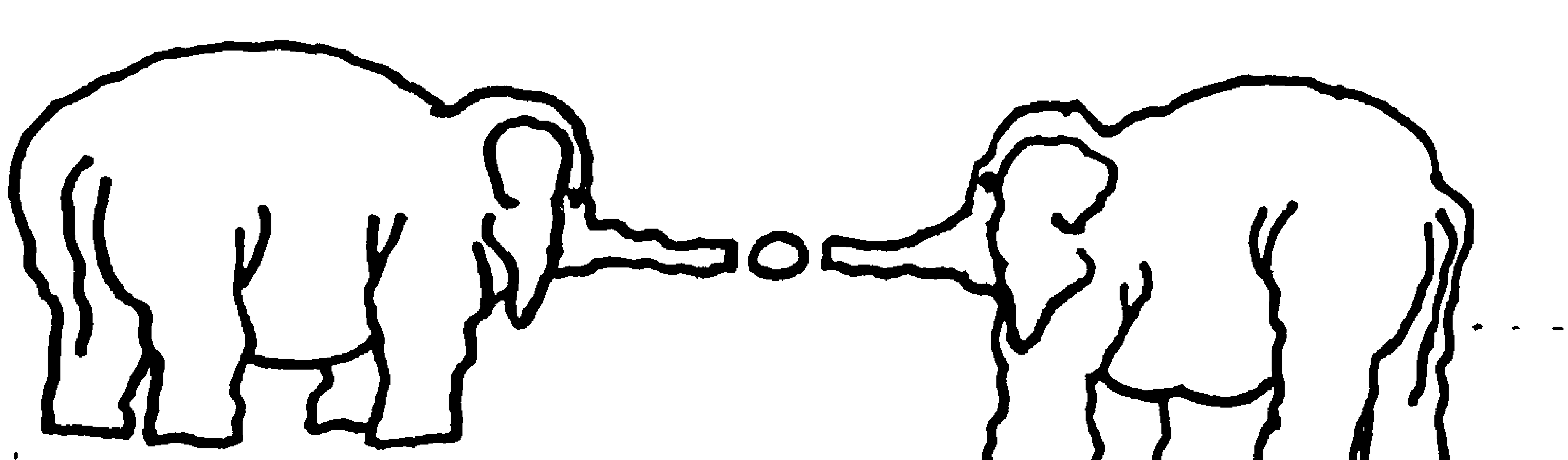


Figure 6.4 "Droodle"- "Two elephants sniffing a grapefruit"

a) The cut out overlay



b) The full picture



The aim of the questioning in this test was firstly to see if the children could hold in their mind perspectives that were different from their own. Secondly, it aimed to discover whether they could invent other perspectives and ascribe them to others and finally, whether they felt it was all right for different people to hold different interpretations of the same object.

The Chandler/Helm experiment sought to test the role-taking competence of children at age 4, 7 and 11. They found that, for the group of seven year olds, success at being able to take on another's perspective was most affected by whether one had previously experienced that role. This was not a factor for the four and eleven year olds. Thus, although the same stimulus material is used for this test in this project, the nature of this experiment is different to that of Chandler/Helm. No attempt was made to replicate their study and as such the results of this test cannot be compared with their results.

4.2.3 Method

Procedure

Two small toy figures were introduced to the child. One was named Bob and one Sam. The child was then shown the full picture of the witch and the boat and asked:

> *"what could you say this is a picture of?"*

Then the picture was covered up with the overlay, allowing only the "droodle" of the two triangles to be viewed and Bob comes to look at the picture. The child was asked:

"What will Bob say this is a picture of?"

This was repeated with the other doll, Sam.

If the child gave different answers for the two dolls they were then asked:

"Is it OK for Sam and Bob to say it is different things?"

"Why is it OK? [not OK?]"

Further questions were asked responding to the child's answers such as:

"How do they know what it is?"

For the second picture (two elephants sniffing a grapefruit), the child was shown only the droodle cut out and again asked the same questions as above.

Part 2 of the test again used Bob and Sam, along with a basket and a treasure chest. Bob puts a jewel in the basket in front of the child and then goes away. Sam comes along and moves the jewel from the basket to the treasure chest and then goes away. Bob returns. The child is asked:

"Where is Bob going to look for his jewel, and why?"

This is another classic false belief test based upon the original Maxi and the hidden chocolate test (Wimmer & Perner, 1983). The aim in administering this test was just to check that all the children had developed at least this level of theory of mind and therefore there was no base level discrepancy between the control and the experimental groups on this measure.

4.2.4 Scoring

0 = the child ascribed to Bob or Sam or both, the same interpretation of the droodle as they had themselves given. (only the child held knowledge of what the full picture was)

1 = the child showed some appreciation that only they held full knowledge of the picture, but they still allowed Bob and Sam some access to this information eg. Bob thinks "it is a witch and Sam thinks it is a boat"

2 = the child invented other disassociated interpretations for Bob and Sam and said it was OK for them to hold these views

Note: If the first droodle was scored as 1 or 2, but the second droodle scored 0 then the test was scored as 0. If the first and second droodle were scored as 1 then the test was scored as 1. There has to be consistency across both droodles to achieve the given score, as in the original Chandler and Helm experiment (1984).

The children who scored 2 in both the experimental and control schools were able to give justification for their thinking. In the experimental schools this was often couched in mentalistic terms. For example, here is Chloe from an experimental school being philosophical:

R=Researcher; C=Chloe

7. R: So Bob and Sam say it's different things is that OK ?

8. C: Yep, because different people have different sorts of seeing and she might not know these are called triangles so she calls them pointy shapes and he might know they are triangles so he calls them triangles.

15. R: So again all three of you now have seen exactly the same thing but you all call it something different is that OK ?

16. C: Yep

17. R: Why?

18: C: Cos again people see different things and they might not know it's a pattern and Sam might not know that it's lines with a circle in the middle, we all see different things and we all know different things because if God made us all the same it would be really really boring cos all of us would be the same, say like we had seven Shirleys and seven Chloes.

Other comments from experimental school children show their reasoning:

Joseph: people think in different ways

John: lots of people think different things so you are bound to think it's something different

Oliver: because we have different brains that think different things

Fumi: they have their own ideas and they will think about their own ideas

Samuel: because they have their own imaginations

Martha: because they've got their own brains, we think different and we've got our own minds and we say different things

The above are all examples of explanations which were scored as a 2. In comparison here are some explanations scored as a 1. They show a great deal more confusion, with reasons linked to age, reality or physical perspectives eg: Denise says that the dolls can give different interpretations of the drawing but the reason:

11. R: Why is it OK for them to say different things?

12. D: Cos one is this side and one is that side

I try to persuade Denise that the dolls are looking from the same place, she seems to agree but then:

23. R: Why will they both say it's different things if they are looking at it from exactly the same place?

24. D: Cos one is a bit at the back and one is in front

Although Denise maintained that they would say it was different things her explanation relied upon the dolls viewing the picture from different places, even if that difference was so slight as to be virtually non existent.

Louise also has a physical explanation:

11. R: Would it make sense for them to think it's different things?

12. L: Yes

13. R: Why could they do that?

14. L: Because one could be older and they could make different decisions and later

29. R: OK so these two have said it's the same thing, but you have said it's something different, is that OK?

30. L: Yeah

31. R: Why is that

32. L: Cos I'm taller

33. R: Right. What difference does that make

34. L: I might be older than them

A child scoring 0 sticks to their notion that different people would give the same interpretation when viewing the same picture even though neither can see the full picture, for example here is Natasha maintaining her ground under cross questioning:

21. R: So they might say it's the same thing, is that OK, why would they say the same thing?

22. N: Cos they're friends

23. R: What about if they weren't friends, if they don't know each other?

24. N: They wouldn't be friends because they don't know each other

25. R: So would it be OK for them to look at this and give it a different title?

26. N: No

27. R: Why not?

28. N: Because they want to say the same things

29. R: Can two people looking at the same picture give it a different title?

30. N: No

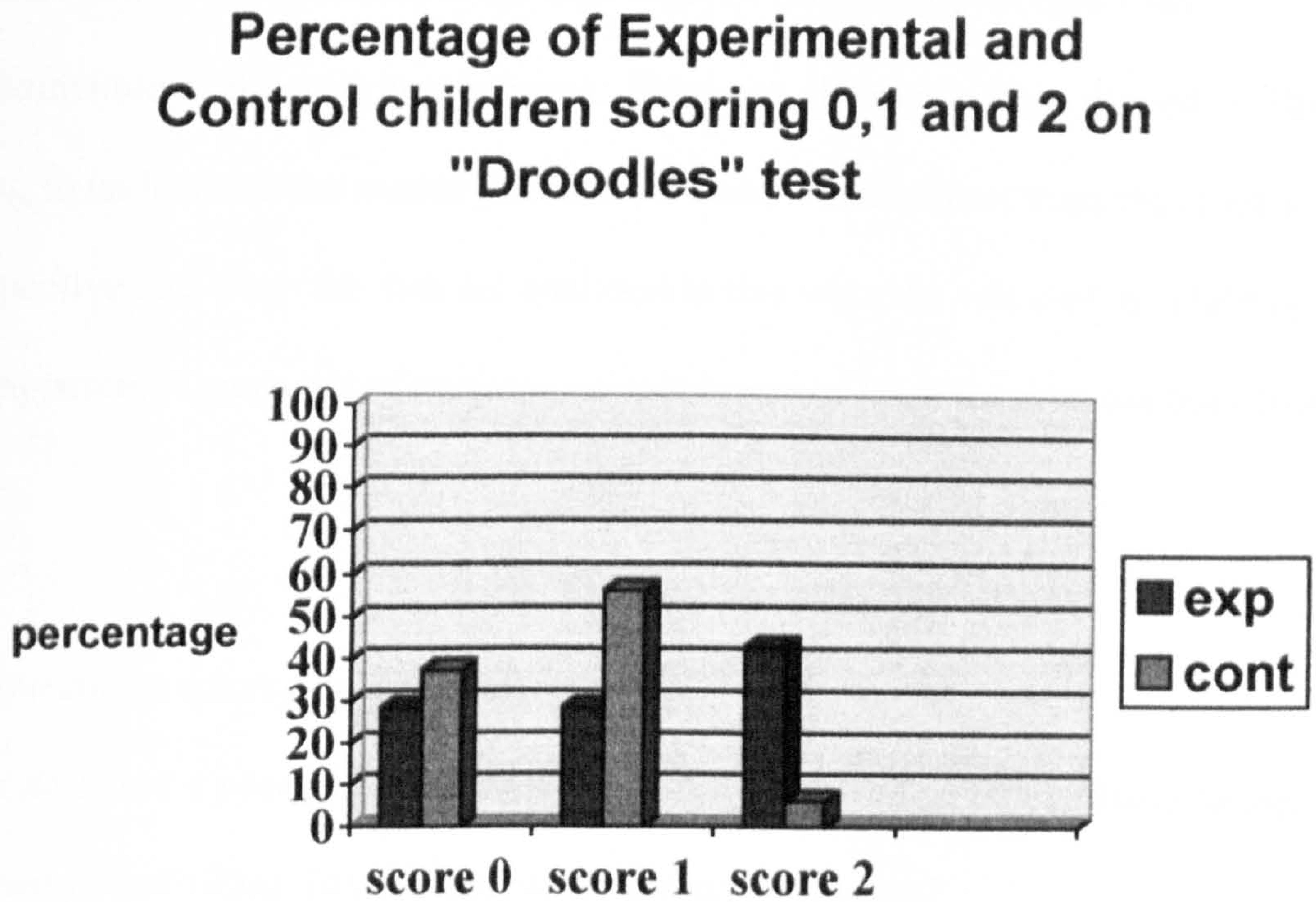
4.2.5 Results

The Smartie tube false belief test administered at the beginning of the year had 100% success. Part two of the theory of mind test (Bob, Sam and the jewel) administered at the end of the year also had 100% success for both experimental and control groups. However, results for the interpretative theory of mind test were not so equal and it is the results from that test which will be discussed further and analysed below.

The "Droodles" test was given to 21 children from the experimental schools and 16 children from the control schools. The children's responses to the questions were audio taped and transcribed. Six transcriptions taken at random were passed to a colleague with the scoring system. 100% inter-rater agreement was achieved.

The results show a large difference between the experimental and control group by those scoring 2, [43% of the experimental group scored 2, whereas only 6.25% of the control group scored 2]. However, if the scores of 1 and 2 are taken together then the two groups are much closer: Exp group 71.5% and Cont. group 62.5%. This indicates that the difference between the two groups is a result of a qualitative difference in reasoning and the explanations given. There was no real difference between the scores of boys and girls.

Figure 6.5



As gain scores were not available for this test, no chi square analysis was carried out.

4.2.6 Phenomenological Analysis

The question posed for the phenomenological analysis is: if the three scores 0,1,2 relate to the development of an interpretative theory of mind, how do the children in these three categories understand the perception of another's reality? Since all the children passed the false belief tests (Smartie tube and Treasure chest) they all have some understanding of others as cognitive beings; can then a phenomenological description indicate the qualitative differences between the developmental stages?

The analysis is limited because the data was not originally collected with phenomenological description in mind. However, the method has proved useful in trying to understand the mental phenomena under examination from the child's perspective and when the data are analysed in this way, the voice of the child is still apparent. Categories of meaning are not imposed upon the data but built from it.

The question explored by this analysis was:

What do 5 and 6 year old children understand about others as cognitive beings in terms of individual interpretations of a visual stimulus?

The method of analysis was that described in chapter 5.

Composite general description of children's understanding of others as cognitive beings from qualitative data of those scoring 0 on the interpretative Theory of Mind test.

50% of the children who score 0 on this test could give no explanation at all for their answers. They maintained however, that different people had to give the same interpretation of the "droodle".

The children who did give an explanation emphasised right and wrong. People looking at the same picture would see the same thing. They could not interpret the picture differently even though the whole picture was not shown. If they did give different answers one of them would be wrong. If we looked at the same picture we would have to agree on what it was. The picture has a physical reality that is fixed and we can see what this is. If one person gave a different answer to someone else it could cause an argument because only one person could be right. The person who is right is the one who says what it really is. Different people would see the same thing if they looked at the picture and they would describe the same thing. They would both know the same thing about the picture so they would not be able to give it a different title. Since both dolls are looking at the picture from the same place (directly in front of it) they could not give different ideas of what it is. Also friends would give the same answer because they would want to agree with each other.

Composite general description of children's understanding of others as cognitive beings from qualitative data of those scoring 1 on the interpretative Theory of Mind test.

The children scoring one were much more open to the idea that different interpretations of the "droodle" could be given. However, their explanations for why this might be tended towards physical properties. They could differ if one of them looked more closely at the picture, because then one of them could believe it was something else. They could say it was a different thing because they are different sizes (in fact the dolls were the same size). Being a different size would mean that one is older than the other and older people can have different ideas about the same picture. This would also happen if one was taller than the other. They could say it is different things because they can see it from different sides (although both dolls were positioned in the same place directly in front of the picture). It would depend on where you stand, what you would say the picture was. They might also say it was different things so that they were not accused of copying each other's answers. This would lead them to fight. But they could also say it was the same thing if they agreed about what it was.

Composite general description of children's understanding of others as cognitive beings from qualitative data of those scoring 2 on the interpretative Theory of Mind test.

The children scoring 2 were able to give explanations for their answers, which showed an understanding of others as cognitive beings.

The dolls would give different interpretations of the "droodles" because they wouldn't know what each other had said it was. Also one of them might "get" the drawing and one might not. They would give different interpretations because they have their own imaginations. They have their own brains and everyone thinks differently. We each have our own mind and we can say different things. Different people have different sorts of seeings, even if they are standing in the same place. Also different people know different things and one person might know what something is called, for instance a triangle, another person might only be able to describe the shape and not know the name of it. People think in different ways even if they are brothers and are looking at the same thing. Everyone doesn't know the same thing. Everyone is a different person and so everyone is bound to say the "droodle" is a different thing. We all have our own brain and different brains think different things. We all have our own ideas. Each person is unique. If we were all the same it would be very boring.

4.2.7 Discussion

The quantitative results show that at the end of the year many more experimental school children are scoring 2 than are control school children. The fact that control school children tend towards scoring at level 1 suggests that maturation and general educational influence would account for this level. Level 2 requires a more sophisticated explanation and shows some real understanding of others as cognitive beings and in some cases of the interpretative nature of knowledge. This degree of sophistication suggests that the experimental school children have at least developed a language of explanation, which is different to that used by the control school children.

The phenomenological analysis suggests a development from level 0 through to level 2 of understanding of cognitive processing. Whilst the level 0 children stick firmly to the idea that reality is fixed and can only be interpreted in the same way by everyone, the level 1 children have moved to a more ambivalent position. They tend to agree that people can differ in their explanations of something as abstract as a droodle, but rely on some kind of physical reason for this, be it age, height or viewing point. Most often, these explanations did not equate with the reality of the two plastic dolls, but the children maintained these explanations, seemingly because they were unable to provide a more interpretative explanation.

The level 2 children have moved on a great deal. Their explanations indicate a degree of reflection and they are able to explain their ideas in different ways. From analysing their comments, it seems clear that they have done more than just learnt a language of mentalistic explanations. They understand those explanations and when cross questioned they do not revert to less mentalistic views. If they had simply learnt a language of explaining themselves by some rote method, we would expect much more talk along the lines of "we all have minds" or "our brains help us think of ideas" etc. But to be able to go further and explain why two people can have different ideas is, I would suggest, much more sophisticated and involves not just language but an understanding of individual cognition. In other words a metacognitive process which is qualitatively different from the processing of the children at level 0 and level 1.

4.3 METAMEMORY

4.3.1 Introduction

Metamemory was one of the first components of metacognition to be studied and as described by Flavell (Flavell, 1971; Flavell & Wellman, 1977), it forms the basis for the concept of metacognition. It involves knowledge of one's own memory; how it works; what factors may influence it as well as an awareness of one's own memory at the moment, including control and monitoring aspects and knowledge of possible strategies that could enhance memory performance. A great deal of work on metamemory and memory performance was carried out in 1970's and 80's. Much of this work focused on children's knowledge of and use of strategies to aid memory performance on recall tasks. In general, it was found that even pre-school children can use memory strategies when the task is simple (DeLoache et al., 1985). However, middle-school children were found to be more likely to understand that a memory strategy can help recall (Moynahan, 1978), although even older children are not consistent in their knowledge and use of memory strategies. Young children have also been found to overestimate their memory capacity, claiming that they can remember more than they do, yet being unaware of the deficit between their prediction and performance (Cavanaugh & Perlmutter, 1982). Children in school are rarely made aware of these differences or specifically taught memory strategies (unless engaged in a particular programme, often designed by researchers).

The purpose of including a metamemory task in this project was initially to get a base line of where the children in the study fell in the developmental metamemory scale, so that a comparison could be made with their level a year later. In addition results from this test could be compared with results from the other three tests to see whether there is a general metacognitive development across all four factors or whether the factors are in fact distinct.

4.3.2 The Test

Sixteen objects were chosen as recall items. These consisted of small plastic toys such as a pirate, a parrot, a fish, a seahorse, a frog and some natural objects such as a leaf, as stone, a shell. . Whilst aware of the cultural significance of these objects, I felt that they were familiar enough to the children to not present a real problem. Many of the toys were from established sets – Playmobil, Lego, which the children had already come across in their classroom, if not at home. The objects were also chosen because they could form a basis for storytelling and pretend play (see qualitative results below) and because they were visually and textually attractive.

24 children age 5-6 years from the experimental group were tested at the beginning of the year (as 3 left before post testing was carried out at the end of the year, only the results of 21 children who completed the year are used), and 16 children from the same age control group were also tested at the same times of year.

Each child was initially asked if they would like to help me find out how children learn things, by playing a game. All the children agreed and appeared enthusiastic to take part. The test was carried out at the same time as the main CASE project testing and as such the children were becoming used to their day being disrupted by researchers and being asked "funny questions". The downside to the method was that some children may have become tired and this could affect their performance. At signs of tiredness the test was ended, although all questions may not have been asked.

The test was carried out away from the classroom, usually in the library or hall, with myself and the child sat side by side at a small table on which the items were placed. The test was tape recorded as well as observational notes being taken. This test was the third, in a sequence of four tests and as such a relationship (of some sort) had already begun to be established between myself and the child.

Firstly the objects were presented on the table and the child asked to name each one. The names the child gave to an object were not changed e.g. some called the pirate, a sea captain or a man and that name was accepted. On only a few occasions was I asked to name an object usually the seahorse and occasionally I was asked questions about whether they were real or not (most often with the toy frog). In answer the object was given to the child and asked what they thought, the name of an object was given when asked for. After initial naming I explained that I was going to give them 2 minutes to try and remember as many objects as they could and that they could do anything they wanted with the objects which might help them. I then explained that after 2 minutes I would cover the objects with a cloth and ask them to recall as many as possible.

The aim of the test was not primarily to see how many each child could recall, but if in follow up questions they could explain what they had done to help them remember them and to express anymore general thoughts they might have about the working of their own memory. Observational notes were taken during the minutes when the child was remembering the items. After recall, the following questions were asked:

"When I gave you 2 minutes to remember the things what did you do to help you remember so many ?"

Sometimes probes were used

"Did you do anything else ?"

Other questions were:

"Was it easy or difficult to remember them ?"

"Why ?"

"How could I make it easier ?"

"Is there anything you could do to make it easier ?"

"If a friend wanted to remember as many as you have, what would you tell them to do ?"

"Which bit of you is doing the remembering ?"

"How does it do that ?"

All the main questions were given to each child, however the probes were adapted to the child's initial answer. The emphasis was on naturalistic conversation (as opposed to test conditions), and as much opportunity as possible was given for the child to give a more detailed explanation. Quite often a child would digress to talking about other things and, time permitting, were given the chance to express themselves as they wanted. Sometimes these stories which seemed initially like digressions, were ultimately linked to memory and learning. For instance, a story about a father forgetting his keys and getting wet, ended in the child saying he should have checked for his keys before he went out. As this could be a repeat of another family member's theory a follow up question would be asked, such as "How would checking help?" and "How would he remember to check?" In this way novel accounts can be integrated into the tests results.

4.3.3 Scoring

The tape recordings and observational notes were transcribed and a scoring system applied. Initially, the scoring system comprised five categories, these were given number codes of 1A, 1, 2, 3 and 4. However inter-coder rating, discussion with peers and other researchers led to a more specific 9 number code system. Firstly, the transcripts were coded for the following behaviours:

Table 6.2 Metamemory Coding System

Category	*Code*	*Description*
Observation	*A*	*Observed using strategies e.g. grouping, naming out loud, making characters etc.*
Performance	*B*	*Remembers 8 or more objects*
	C	*Remembers less than 8 objects*
Explanation	*D*	*General explanation of how remembered eg. thinking, using brain, looking*
	E	*Explains how remembered with specific refs to memory strategies eg. counting, naming, putting in order*
	F	*Further explanation of own memory and how it works eg. "easier to write them down", less objects makes it easier, don't always remember things, "my brain remembers things because I tell it to"*
	G	*No explanation*

Occasionally, the transcripts showed that a child simply repeated something I said and if no further explanation was forthcoming this was discounted from the results as being a leading question.

Again the scoring system was given to two other researchers to check reliability. An inter-coder rating of 98% was achieved and differences solved by discussion. The codes were then combined to form a scoring system, (see table below). As my interest here lay in the quality of the explanations given the highest scores were given to those with the most sophisticated explanations. G or a score of 1 indicates that no explanation was forthcoming. The coding system was derived from the data and as the only children who were not noticeably using any mnemonic strategies were also those who provided no explanations, a single code of G was allocated to this group. All the other children were observed doing something with the objects.

Table 6.3 Metamemory Scoring System

Codes	*Score*
A+B+E+F	*9*
A+C+E+F	*8*
A+B+E	*7*
A+C+E	*6*
A+B+D+F	*5*

A+C+D+F	*4*
A+B+D	*3*
A+C+D	*2*
G	*1*

It was hypothesised that the scores from the pre-test for both groups would cluster around the lower marks and that one year later there would be an increase in all scores due to maturation and development. Any marked difference between the post test scores of the two groups would demand further analysis.

4.3.4 Results

Both experimental and control schools had similar pre-test results with 95.1% of the experimental group scoring 5 or less and 81.25% of the control group scoring 5 or less. However, the post test results show a much larger difference between the two groups. For the experimental group 90.3% scored above 5 on the post test whilst only 37.5% of the control group scored above 5 on this test. There was no particular gender difference either in the pre or post test results for either group.

The experimental schools post test results show a marked increase in scores of 7,8 and especially 9 compared with the control schools post test. The only difference between a score of 8 and 9 is the number of items recalled. Taking scores 8 and 9 together 61.8% of the experimental group fell into this category at the post test stage compared to only 6.25% of the control group.

Figure 6.6

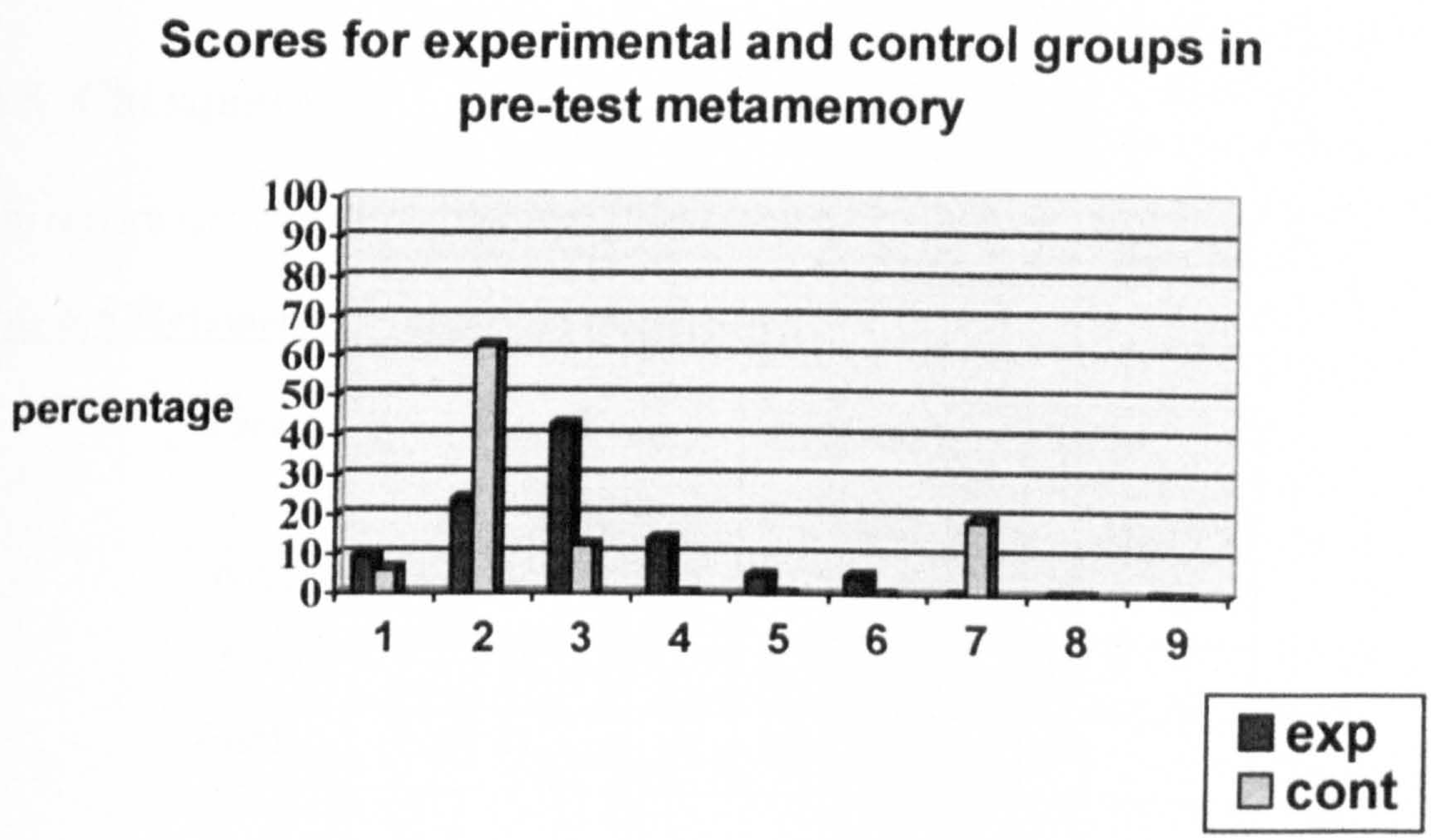
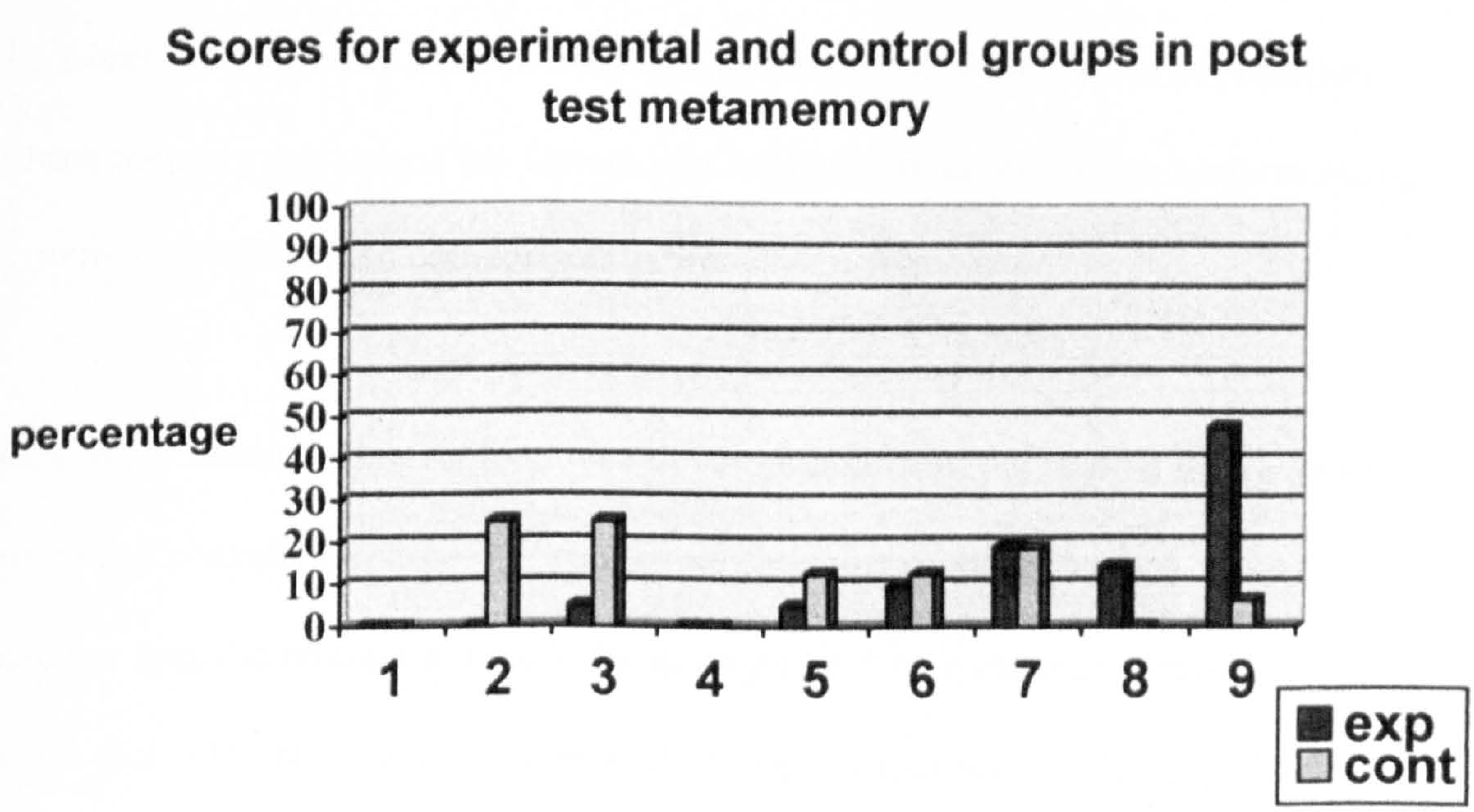


Figure 6.7



4.3.5 Chi square

A chi square test was carried out using gain scores.

Table 6.4 Metamemory (observed frequencies)

score	no of exp children	no of cont children	Total
<0,0,1,2,3	6	12	18
4,5,6,7	15	4	19
Total	21	16	37

$\chi^2 = 9.82$ df = 1 $p < 0.01$

4.3.6 Summary

The experimental group showed a marked difference in their further explanations of how memory works and the factors that influence it, as well as an understanding of memory strategies, in comparison to the control schools.

The control schools show a more even development from pre to post test, with the percentage obtaining a score of 7 remaining the same on both tests. A score of 7 indicates specific reference to memory strategies but no further explanation of factors that influence memory. This ability to go further seen in the large 8 and 9 scores of the experimental schools indicates a possible difference in approach to memory in the two types of schools. This phenomenon is analysed further through the classroom observations

The results of the chi square test suggest that CASE@KS1 has a positive effect on the development of metamemory as measured by this test.

4.3.7 Phenomenological Analysis

Whilst the quantitative scores and analysis show differences between the two groups on the metacognitive factors analysed, it remains the case that metamemory is an adult concept, a theory developed and described in terms of psychological theory. In order to understand more about how children of this age describe these factors we call metamemory, a phenomenological analysis of the qualitative data was carried out using the method described in chapter 5 . The question this analysis seeks to answer is:

"how do children of five and six years old experience remembering and what do they know about their own memory ?"

Composite general descriptions of remembering were produced in four categories as follows:

category 1 = those scoring 2 & 3

category 2 = those scoring 4 & 5

category 3 = those scoring 6 & 7

category 4 = those scoring 8 & 9

Specific descriptions of remembering were composed for each child from their answers to my questions in both the pre-test and post test . These were further analysed and transformed to provide essential general descriptions for each child scoring in the above categories.

Composite general description of remembering category 1

For children scoring in this category remembering is largely a mysterious process. It is automatic and linked to "cleverness". Mothers in particular never forgot things even though they had to make lists to remember shopping. The list making did not help them to remember. Remembering is about looking at things. Remembering is done by the eyes and the arms, but this cannot be explained and is an automatic process. Remembering is connected to using your brain and thinking. Whilst these children were observed seemingly using some type of memory strategy eg. quietly repeating the names of the objects to themselves, their subsequent descriptions of how they remembered them never matched the observation. Such strategies were denied as being of any use in remembering things.

Composite general description of remembering category 2

Those scoring in this category connected remembering with using their brain. Some people have good memories and some have bad. Remembering is described as a "coming to" and can be helped by an outside agency, either a mother or a spiritual agency like God. Being unable to remember makes one feel sad. Remembering was connected to the memory and the memory was located in the brain and was seen as a store house which required "clearing out" before new things could be put in to be stored for later. In general the children believed their memory to be trustworthy. It would not give them false answers. Remembering is not easy and sometimes you might have to guess.

Composite general description of remembering category 3

Children scoring in this category said that removing the objects from sight made it difficult to remember them. Naming objects out loud or to oneself can help in remembering them. It is easier to remember things if you use a strategy, but not all strategies are good. Making stories from the objects and giving voice to the characters will help to recall the objects. Making order out of the objects in terms of putting things next to each other or in alphabetical order will help you to remember them. One child described "sorting out" as firstly putting all the objects one at a time into a circle made from a necklace, this was "sorting in" then removing them one at a time, this was "sorting out" and the whole strategy would help you to remember the objects. The objects could be grouped or put into a pattern and that would enable you to remember them. Touching the objects is especially important because the feel of the object can be stored in your brain and recalled later. Equally knowing and saying the names of the objects would help recall. Counting, closing your eyes or writing a list are also good strategies for remembering.

Composite general description of remembering category 4

Remembering a large number of objects necessitates becoming fully involved with them through the senses especially touch and sight. It helps if the objects themselves form a cohesive group and if they can be sorted out in some way.

Repeatedly naming the objects out loud or to oneself can help in remembering them. It is easier to remember things if you are told to remember them.

Remembering is linked to learning but is not the same thing. We can learn by watching others but we cannot remember that way and remembering is different from learning to read and write. Strategies that help in reading and writing, like copying, do not help in remembering. To remember things you need to think. Thinking and remembering take place in the brain but they are not the same thing. Remembering is performed by the memory and thinking about things or concentrating on them allows those things to enter memory and be stored there until they are needed, when thinking about them again will bring them out again. Remembering is both an internal and physical act. There is a mystery to how the things to be remembered enter memory, but once there, they are real.

Memory is located in the brain or in the head. It takes concentration to remember things and you need to work hard at it. The brain is a control centre for the body; it is different to the heart. But the brain is physical, it requires "warming up" or "exercise" before it begins to work and something inside the brain starts it working. The brain is fallible, it can get things wrong and it can find things difficult. Remembering is not easy and knowing that you have forgotten something brings about an emotional experience, it makes you feel sad.

Using strategies like naming will help you to remember. The first objects to be named will be the first to be remembered. Fewer objects would be easier to remember. One strategy mentioned was a form of "chunking" described as "put a few in your head at once and then put in some more". Seeing a real thing was more memorable than a picture or a toy.

4.3.8 Discussion

The quantitative results of this test showed a marked difference between the scores of the control and experimental schools in the post tests. The increase in numbers of experimental school children scoring highly on this test indicates that they are giving qualitatively different and more sophisticated explanations of how memory works and the factors that may influence it.

The results of the chi square test suggest that CASE@KS1 has a positive effect on the development of metamemory as measured by this test. The quantitative results are further verified by the phenomenological descriptions derived from the transcribed test data at the end of the year. The analysis of the descriptions of remembering in those children scoring 6, 7, 8 and 9 on the test, show a remarkable insight for children of this age. They are aware of possible strategies that may help us to remember and ideas of how remembering works, its link to memory and thinking, and how it differs from other cognitive processes. Whilst not all children, even by the end of the year, had these kind of insights, the children in the experimental group were more able to explain their thinking about remembering than those in the control group. The phenomenological analysis has helped to highlight the sophistication of these explanations and provides a unique understanding of how children of this age can think about, conceptualise and explain their thinking about the process of remembering and the concept of memory.

4.4 MENTAL ROTATION

4.4.1 Introduction

Whilst the previous three tests have tested for specific factors of metacognition namely knowledge of self, knowledge of others and knowledge of memory, this fourth test concentrates on knowledge of problem solving. It addresses the questions – What do five and six year olds know about how they solve problems? and Are they aware of the mental processes they may be using? Knowledge about how we solve problems allows us to make informed choices about the type of problem we have to solve and the best method to use. Awareness of the thinking process involved in each problem solving situation will enable us to match the most effective strategy to both the task and to our knowledge of our own cognition. For the purposes of this project, a test was used which would stimulate children into explaining and describing how they had solved the problems. Can five and six year olds who successfully solve a mental rotation problem explain how they did it? What explanations would those who were unsuccessful at solving the problem give? Would the test show children of this age to be the mental realists that Piaget suggested (ie. viewing mental processes as objective phenomena) (Piaget & Inhelder, 1969), or can they explain their thinking in terms of mental representations? David Estes, (from whose work the test was adapted), has suggested that even four year olds can have some access to their problem solving processing. In his study, those four year olds who referred to mental processing to explain their results on the mental rotation test, produced results consistent in reaction time and error rate with mental rotation processing. Those who did not refer to mental activity to explain their results were found to have responded randomly. (Estes, 1998)

Metacognitive processing in terms of conscious knowledge of the mental processes involved in problem solving has also been found to be the significant factor in successful problem solving by other researchers, (Antonietti, Ignazi, & Perego, 2000; Chi et al., 1980; Chi et al., 1982; Davidson et al., 1994; Schoenfeld, 1992; Swanson, 1990). The pilot study for this project had shown that most ten to eleven year olds could explain the cognitive process they used to solve the mental rotation test, whereas the year one children in the pilot study gave a much broader range of explanations. Would the results of the year one children in the main study replicate those in the pilot study and would the CASE intervention programme, which is based on collaborative problem solving, positively affect the development of this aspect of metacognition?

4.4.2 The Test

The mental rotation test was adapted from the computerised test used by David Estes (1998), with his permission. The original test measured reaction times and performance as well as seeking explanations. The pilot study for this project involved changing the test to suit this project and the aim of eliciting explanations rather than measuring performance. Four cards were produced. On each card was a drawing of two monkeys. Each monkey had one arm in the air. On cards A and B the monkeys had the same arm in the air and on cards C and D the monkeys held up different arms. Cards B, C and D showed the second monkey rotated firstly to 90° then 120°and finally to 180°, (see page 221, for copies of cards). The child was shown card A and asked if the monkeys had the same arm in the air or different arms. The question was repeated for each card. The child was re-shown card D and asked to explain the answer they had given. Further questions followed from the natural responses of the child. These were:

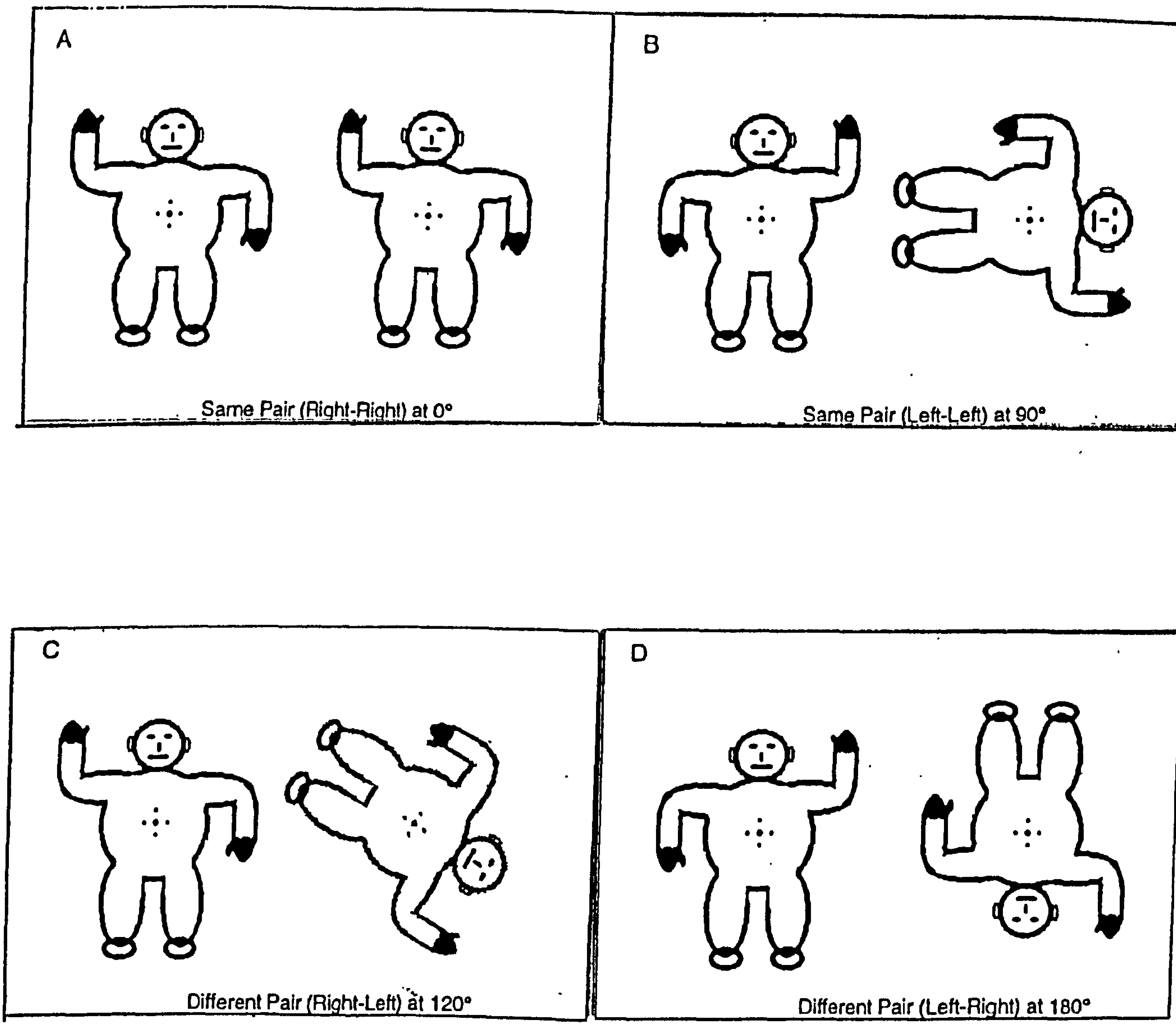
How did you work it out?

Which bit of you did the working out?

Was it easy or difficult?

What was easy or difficult about it?

Figure 6.8 Mental Rotation Test Cards



The test was administered to both control and experimental groups at the beginning and again at the end of the intervention year. At the beginning of the year n exp = 24 and n cont =18, by the end of the year this had diminished to n exp =21 and n cont = 16. Results are given below using the sample size present at the end of the year.

4.4.3 Scoring

Following Estes' categorisations (Estes, 1998),explanations were coded into three groups:

Non mental = all references to physical rather than mental explanations or no explanation at all (eg. "this arm up and this arm down", knowledge of left and right)

General mental = all references to general thinking (eg. "I thought about it", "I used my brain")

Mental Rotation = all references to specifically rotating the image mentally (eg. "I turned it around in my mind")

These explanations were converted to numeric scores:

Non mental = 0

General mental = 1

Mental Rotation = 2

A 20% sample of the pre-test data was selected for marking by two other researchers. 100% inter-rater reliability was achieved.

Whilst some of the children who scored 0 and gave incorrect answers to the cards simply guessed the answer, others were observed trying to work them out. This often involved physically twisting their body or trying to look at the card upside down. Here is Julien from Control School Y demonstrating how he worked out card D at the pre-test stage (although he got the answer wrong):

12. R: How did you work this one out?

13. J: [turns card around with his hands]

14. R: that's interesting what did you just do?

15. J: turned it over

16. R: but because they are on the same card if you turn it over the other monkey goes upside down, is there any way you can do it?

17. J: draw another monkey, the same way up

24. R: which bit of you are you using to work it out?

25. J: hands and fingers

Whilst Julien gets close to the idea of rotation he can't yet make the processing leap from physically turning the card around, which in effect doesn't help at all, to mentally turning it around. Whether he had tried to mentally rotate the second monkey or not we cannot know, but we can say that he didn't succeed in doing it and he wasn't aware that was how he had tried to solve the problem. He may have used only a physical rotation method.

A number of children at the pre-test stage who scored 0 were unable to give any sort of explanation of their problem solving, suggesting that they guessed the answers to the cards. Similarly, at the end of the year Sarah from experimental school A also gives a non mental and physical answer:

6. R: Look at card D again tell me how you worked this one out

7. S: because there was one the right way up and the other upside down I got up and looked at it like that (moves around to the other side of the table and twists body) and I knew them two were not the same cos that one is a little bit longer

8. R: why did you get up and move around like that?

9. S: because that one was upside down

10. R: if you move around that side of the table won't the other one be upside down?

11. S: yep

Whilst Sarah maintained this as her strategy the explanation for it became no clearer as the conversation continued. This lack of clear explanation is not simply an age-related issue, as can be seen by comparison with the few same age children who scored 2, for example Finn from control school Z at post test:

3. R: Ok let's look at picture D – tell me how you worked that out

6. F: because I put them in my brain and then I turned this monkey around and then it was different

11. R: was it easy or difficult?

12. F: easy

13. R: which was the easiest card?

14. F: [chooses card A]

15. R: which was the most difficult?

16. F: (chooses card D)

17. R: why was that one more difficult?

18. F: because that one (card A) *is not upside down and they are the same and this one* (card D*) is upside down and you have to turn it around in your head.*

Pritti from the same school agrees, although she is observed physically turning and twisting her head to work out card D:

3. R: How did you work out card D?

4. P: I imagined this monkey was like that (uses her fingers to turn it around) *and then I know the answer*

9. R: which bit of you did all that working out?

10. P: my brain

13. R: which was the most difficult card?

14. P: C and D

15. R: why?

16. P: because this one is this way and the other is the other way (ref to card D on which one monkey is upside down)

Chloe and Oliver from experimental school B and Samuel from experimental school C also explain their thinking clearly at the post-test:

3. R: How did you work out card D?

4. C: I just tried to turn them over in my head and put it over each other and see which one is like the same, so I put it over in my head and see if it's the same

4. O: I like memorised it turning it around in my head

7. S: I just turned it over in my brain and then put them together again

Here is Victoria (experimental school C) with a typical 1 score answer at post test. Whilst she got card D right, card B was incorrect:

8. R: Tell me how you worked out this one (D)?

9. V: in my head

10. R: what did you do in your head?

11. V: I worked it out

12. R: how did you do that?

13. V: with my brain

Or Natasha from Control School X scoring 1 at post test:

7. R: How did you work it out?

8. N: cos I'm trying hard in my head and I can do it

19. R: which bit of you is doing the working out?

20. N: my brain

And Hera from control school Z maintaining a general mental answer under intentional leading questions at the pre-test stage:

6 R: How did you work out card D?

7. H: I thought about it and that one is down, that one is up

8. R: so how do you know that that arm is different to that one?

9. H: because he's upside down

10. R: so what did you do to work it out?

11. H: I thought that was up and that was down

14. R: would you have to do anything to make him look like that monkey?

15. H: turn him around

16. R: but if I turn the card around the other one is upside down, is there any other way you could turn him around

17. H: [pause]

18. R: which bit of you could turn these around without moving the paper?

19. H: my feet, my hands

20. R: could you turn them around in your head?

21. H: no

22. R: could you turn them around by thinking?

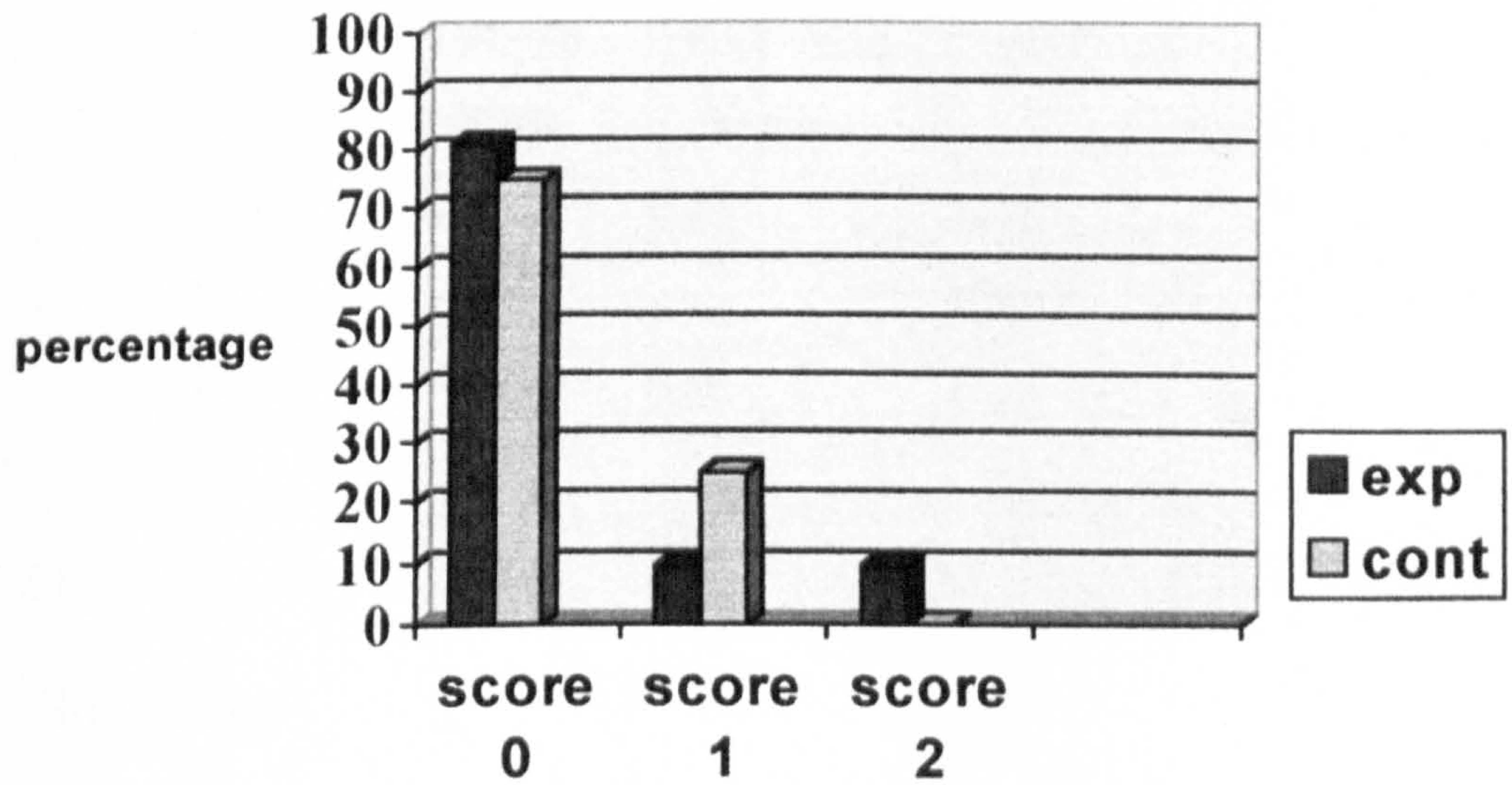
23. H: no

4.4.4 Results

Results are given for 21 children in the experimental group and 16 children in the control group.

At the beginning of the year the majority of children (81% exp and 75% cont.) scored 0 on this test, ie. they gave non mental explanations or no explanation at all and all but one of these children gave incorrect answers for the four cards. There was no apparent gender difference. At the end of the year there was only a small improvement. 28.5% of the experimental group scored 2 compared to 18.75% of the control group. The majority of children in both groups still scored 0.

Experimental and Control Schools Pre-Test Mental Rotation



Experimental and Control Schools Post-Test Mental Rotation

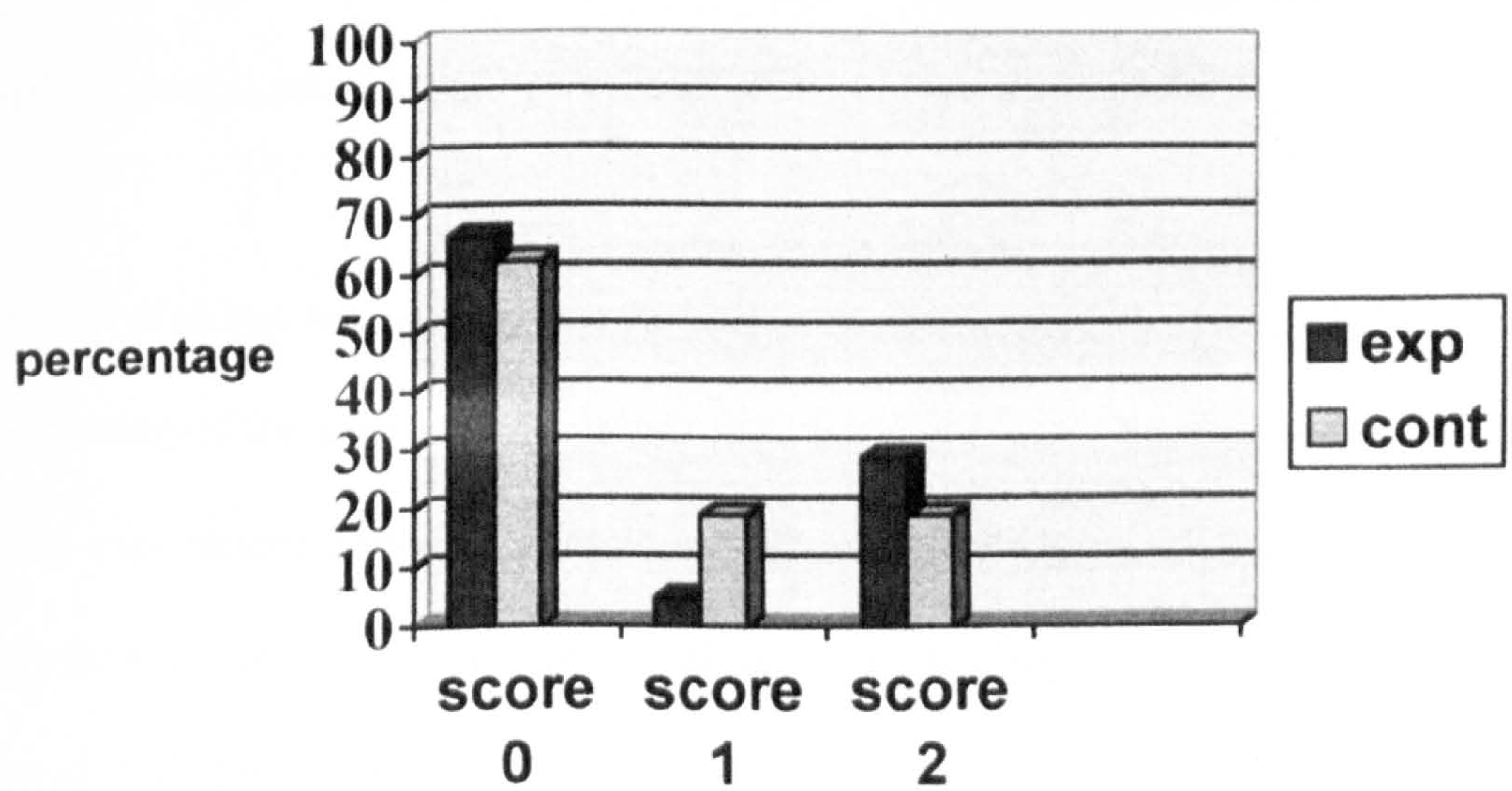


Figure 6.10

4.4.5 Chi square

A chi square test was carried out using gain scores. (See appendix 6.1 for metacognitive gain scores for three tests).

Table 6.5 Mental Rotation (observed frequencies)

score	no of exp children	no of cont children	Totals
-1,0	16	10	26
1,2	5	6	11
Totals	21	16	37

$\chi^2 = 0.81$ df=1 n.s.

4.4.6 Summary

The quantitative results show only a slight difference between experimental and control groups at post test. The chi square result is not significant. Thus it appears that the CASE@KS1 project has not had a marked effect on the children's ability to explain mental rotation.

Of the few children who gave some kind of general mental answer (scored 1) at the beginning of the year not one got all four cards correct. However, two children from the experimental schools gave mental rotation explanations at the beginning of the year and both these children had all four cards correct. The same correlation happened with those scoring 2 (ie. giving mental rotation answers) at the end of the year. Thus it may be that once the children can solve the problem they are likely to able to explain how they did it. The children gave the correct answers before they were asked how they had worked them out.

The control schools scored considerably more 1s at pre and post test. (25% of the control group scored 1 at pre test and 18.75% scored 1 at post test compared to 9.5% of the experimental group scoring 1 at pre test and only 4.8% scoring 1 at post test).

In order to understand better how these five and six year olds explain their problem solving abilities the data were subject to a phenomenological analysis in line with the analysis used for the other three tests. Since the quantitative categories of 0,1,2 are fairly crude divisions between non mental, general mental and mental rotation answers, the phenomenological descriptions can add depth of meaning to these scores and give some insight into what children of five and six know about their problem solving, mental processes. The method for this analysis is fully explained in chapter 5 and so only the composite general descriptions are given below:

4.4.7 Phenomenological Analysis

Composite general description of those scoring 0 (or giving non mental answers) on the mental rotation test

Although this group also contains those who could give no explanation for how they solved the mental rotation problem, many other children were observed trying to work the problem out and subsequently tried hard to explain how they had done it.

A knowledge of left and right was seen to be important even though it was often incorrect and didn't produce correct answers on the tests. However, this knowledge in its correct form would be a useful strategy to use to solve the problem, so knowledge of the usefulness of the strategy was present. One's own perspective in relation to the monkeys was also important. Standing on your head or being able to change your perspective by twisting your body or trying to look at things sideways or upside down would all help to solve the problem. The emphasis lay with the solver to do something to enable the problem to be solved. This causes difficulty because it is hard to twist your body around or put your head upside down, even though it would be useful to do so. It is important to look very carefully at the monkeys. There may be a clue, for instance that one is slightly bigger than the other, or that they have different feet or are different colours. This would mean that you could say they were different without having to turn one monkey around. Similarly you could just guess that they were all the same. Whilst it seems clear that one monkey needs to be turned around to be compared with the other monkey, the only way you could do this would be either by drawing the monkeys again, or cutting one out and turning it around. You might use your fingers to trace one monkey and then remember its position whilst you trace the other one and then match them. Memory seems to play some part in the solution. Clever people would just know how to do this and would not need to work it out.

Another strategy might be to think about real monkeys in the zoo and remember how they hold onto trees. Whatever the solution, the monkeys would need to be turned the right way up because it would damage them to be upside down. Their position on the card determines how difficult the problem is. The most difficult one being when one monkey is rotated a full 180°.

Composite general description of those giving general mental explanations (scoring 1) for the mental rotation test

For the children scoring 1 on this test, their understanding of problem solving had moved from it being something of a physical process to knowledge that it is a mental process. There is an understanding that problems have to be worked out and this working out takes place in the brain. The brain tells us what to do. You need to try hard in your head and then you will be able to do it; so effort is necessary. Looking carefully is important but you also need to think about it in your head. Your eyes or hands can help you but it is your head and your brain that works out the problem by thinking about it. Your brain can pretend things about the monkeys, which may help you to work it out e.g. that their face is in a different place. But mental rotation of the image is not possible.

Composite general description of those giving mental rotation explanations (scoring 2) on the mental rotation test

The children who scored 2 on this test all referred directly to mental rotation as a problem solving strategy in this case. It appears to be easy, obvious and a natural thing to do. "Just" is a frequent word used in this section. You just need to turn the monkeys over in your brain and put them together again. You just need to use your brain to move the monkeys around then you will get the correct answer. Just turning it over in your head means that you can see if it is the same as the other one. Whilst it takes practice to be able to do this it is the best way to solve the problem and it leads to correct solutions. It is not clear how we learn to do this but your brain thinks for you and tells you to pretend that one monkey is turned around so that you can think about it easier. It may be your memory that helps you to do this or you have to use your imagination. Your eyes help your imagination to see things the other way round. Once you can do this you wouldn't solve the problem in another way.

4.4.8 Discussion

From the quantitative results it appears that mental rotation is a fairly sophisticated strategy. The majority of children across both groups gave non mental answers at the beginning and the end of the year. The chi square result using the gains from pre- to post test indicated that the CASE project had not impacted on the children's ability to reflect on the mental processing necessary to solve a mental rotation problem..

Once the children are able to explain the mental rotation strategy they gave largely correct answers to the problem and vice versa. Once they are giving consistently correct answers, they tend to be able to explain that they used mental rotation as a strategy. Similarly, once this strategy is conscious and is able to be explained, it becomes the most natural solution, the easiest and most obvious way to solve the problem. The children who gave non mental answers produced a number of different possible solutions in a seemingly "brain storming" way. But once mental rotation had become conscious, the children no longer freely suggested alternative strategies.

Knowledge of problem solving strategies has long been accepted as crucial to successful problem solving (Chi et al., 1980; Flavell, 1976; Hayes, 1981). This conscious knowledge allows us to choose strategies that will best fit both the task and the problem solver. Recent work by Antionetti has suggested the importance of visualisation for problem solving:

> "Individuals who represent problems in pictures or through mental images are facilitated in considering all the elements of the problem simultaneously, in schematising the structure of the problem and in changing the perspective. Experimental findings support the notion that instructions to visualise help subjects to restructure problems (Antonietti et al., 2000)p.3

The children scoring 2 in this test clearly explained their strategy in terms of imagining or seeing the monkeys turned around. Even the children who gave non mental answers tended to stress the importance of their eyes and seeing for solving the problem. Becoming consciously aware of these types of problem solving strategies is a development of metacognition. Practice on solving problems and maturation appear to aid this development the most. Whilst the phenomenological analysis showed the experimental group to give slightly more sophisticated answers than the control group this could be accounted for by differences in linguistic ability at the pre test stage. Whilst non-CASE classroom activity at the present time in year one does not allow for much, if any, collaborative problem solving, obviously some problem solving activity goes on. The nature of the CASE lessons with their highly structured problem solving should impact on the development of conscious processing and strategy use. The fact that this has not shown in these quantitative results may be because a year is not long enough to assess the impact of such a programme.

The next section correlates the results from all four of these tests of metacognition with both the CASE project pre- and post test scores, and with the longer term national school tests (SATS) at the end of year 2.

5 METACOGNITION, COGNITION AND ACADEMIC ATTAINMENT

A fundamental question, which is addressed in this chapter, concerns the nature of metacognition itself. Is metacognition one general factor of cognition or are there specific metacognitions linked to different aspects of cognition, developing separately and on their own time lines, having in common only the fact that each involves a reflection on a parallel aspect of cognition?

The four tests presented here were derived from the literature and designed to cover four major areas of metacognition: knowledge of self as learner, theory of mind, metamemory and mental rotation (the ability to use and be aware of using mental processes to achieve a goal). A correlation of results from each test with the other tests, both pre- and post- intervention, could suggest whether these tests were tapping one general cognitive process or not.

Spearman rank correlations were carried out for the pre-test scores for three tests: self as learner, metamemory and mental rotation and for the post test scores for theory of mind (droodles), metamemory and mental rotation.

5.1 Results of Spearman Rank Correlations

Table 6.6 Correlations for pre-test scores (experimental and control)

	pre- as learner	pre- metamemory
pre- metamemory	0.21	1.0
pre- rotation	-0.02	0.2

Table 6.7 Correlations for post- test scores (experimental and control

	post as learner	TOM	post metamemory
TOM	-012	1.0	0.28
Post metamemory	0.02	0.28	1.0
Post rotation	0.11	-0.17	0.05

The results of this analysis showed no significant correlation between the four tests.

5.2 Discussion

The lack of a correlation pattern over the four tests suggests that there are problems with the idea of the tests tapping one general metacognitive process. Whilst there are problems around measuring metacognition, the use in this study of phenomenological analysis of the test data suggests some internal validity for each test, in that each test appears to be tapping into metacognitive processing in that particular domain.

Some discussion of the literature pertaining to the theoretical issue of whether or not metacognition is one unified aspect of cognition has been undertaken in chapter 2. However, the analysis of these tests suggests that these four aspects of metacognition are independent of each other. A study by Thorpe and Satterly, (1990), examined four commonly used measures of metacognition (generating strategies, word list generation, organisation of prose and judging task difficulty) to see if a common metacognitive factor could be identified. The research parallels this study in that it was conducted with primary school age children, although the youngest were seven years old (a year older than for this project). Results from their four tests showed a clear age related developmental trend from the seven year olds to the eleven year olds. This is replicated by evidence from the pilot study for this project where the mental rotation task was administered to six year olds and eleven year olds, (see chapter 4).

In the Thorpe and Satterly study, a factor analysis of the variables identified in each of their four tests found that there was no evidence for a common metacognitive factor across the measures. They conclude that metacognition is "specific to the task from which it is derived" (p.19), and that they could not support the theoretical claim of a general metacognitive factor.

Whilst this study tends to support the Thorpe and Satterly research, it is also probable that the small sample size and the difficulty of using self-report measures with children of five and six years old have affected the quantitative results.

5.3 Metacognitive and Cognitive Gains

In order to address the research question of whether metacognitive gains can be related to cognitive gains, the gains for each test were correlated with gain scores for the main CASE@KS1 pre and post test. The metacognitive gains were then correlated with the end of year 2 UK national academic tests in language and mathematics.

The main CASE@KS1 project carried out pre- and post intervention tests of both the experimental school children and the control school children. A one third stratified sample of all the children was individually tested on classic Piagetian conservation tasks of number, liquid amount, solid amount and weight. (Piaget & Inhelder, 1974). A further test of spatial awareness based on Piagetian protocols (Piaget & Inhelder, 1976), and further developed by CASE researchers was administered to all the children in groups of six, (Shayer, Wylam, Kuchemann, & Adey, 1978)

These tests were taken as measures of cognition. Results of the main CASE@KS1 project showed that the experimental group made significantly greater gains in cognitive development than the controls. An effect size of 0.47 was reported, (Adey et al., 2002). Academic gains were measured by results on key stage 1 national curriculum tests in language and mathematics taken at the end of year 2, but at the time of writing no effects have been reported on these measures.

Spearman Rank Correlations were carried out for each of the four tests with the results of the conservation tests, the drawing test, the post intervention Ravens scores and the end of year 2 national curriculum tests. This should tell us if metacognitive gains as measured on the four tests presented here are related to cognitive and academic gains.

5.4 Results of Spearman Rank Correlations

Table 6.8 Cognitive gains correlated with metacognitive gains (exp and cont)

	gains consv	gains draw	gains self	gains mem
gains draw	0.017			
gains self	0.315	-0.201		
gains mem	-0.402	0.165	-0.226	
gains rotat	0.204	0.051	0.288	-0.057

Table 6.9 Cognitive gains correlated with metacognitive gains (exp only)

	gains consv	gains draw	gains self	gains mem
gains draw	0.139			
gains self	0.205	-0.015		
gains mem	-0.384	0.275	-0.081	
gains rotat	0.051	-0.187	0.247	-0.011

Gains on the cognitive tests showed only a weak correlation with gains on the three metacognitive tests. Some negative correlations were found between gains on the conservation and drawing tests and the three metacognitive tests.. There was a stronger correlation between raw scores for the experimental and control schools on pre-test drawing and pre-test metamemory (exp 0.573, cont 0.511). Scores for the experimental schools on pre-test mental rotation correlated with experimental schools scores on pre-test drawing (0.579).

5.5 Discussion

The lack of strong correlations between gains on cognitive and metacognitive tests could be due to methodological issues or to theoretical issues. Looking for correlations from the gains on these two types of test is problematic because the tests use different scoring methods. There was no attempt to standardize scores on either set of tests. Whilst significantly larger cognitive gains were reported for the experimental group compared to the control group (Adey et al., 2002), a significant increase in metacognition was only reported for one test, metamemory. Whilst some pre-test scores correlated more highly (eg. drawing and metamemory and drawing and mental rotation), the pattern is not sufficiently strong to make any theoretical conclusions about the processes these tests were designed to examine. The negative correlation between conservation gains and metamemory gains is particularly difficult to ascribe to any theoretical cause. It seems more likely that this is a result of unequal scoring systems and the difficulty of comparing cognitive measures with metacognitive measures. The lack of a strong correlation between cognitive and metacognitive gains over the year defies the theoretical literature which has over time consistently reported positive correlations between cognition and metacognition, (see chapter 2). Reasons for this lack of correlation may include the time scale (one year not being long enough to develop metacognitively), the scarcity of metacognition even in the CASE@KS1 tasks and the lack of facilitation of metacognition outside of CASE@KS1 tasks. These issues are further explored in the next chapter.

6 METACOGNITION AND ACADEMIC RESULTS

The CASE@KS1 project measured academic attainment for the experimental and control groups based on the results of end of year 2 national tests in language and mathematics. As gains could not be calculated for the academic tests, Spearman rank correlations were carried out using the raw scores on the individual metacognition tests and the scores on the two academic tests.

6.1 Results of Spearman Rank Correlations

Table 6.10 Correlations of metacognition tests and academic tests (exp and cont)

	lang	maths
pre as learner	0.364	0.075
pre memory	0.189	0.152
pre rotation	0.096	0.081
TOM (droodles)	0.247	0.155
post memory	0.409	0.267
post rotation	0.133	0.253
lang	1.0	0.588

The correlations for the combined experimental and control schools show no significant correlation between scores on the metacognition tests and scores on national curriculum tests in language and mathematics.

When the experimental schools are partialed out there is a stronger correlation between pre metamemory and language (0.462) and theory of mind and language (0.403).

6.2 Discussion

The analysis of the test data found no significant correlation between scores on any of the tests of metacognition and scores on national key stage 1 tests in mathematics and language.

These results counter other research (discussed in chapter 2) which suggests that metacognition has a more positive effect on academic performance. Recent research has investigated this notion along with an exploration of the nature of metacognition itself. Veenman, Wilhelm and Beishuizen (2004), tested children of 9, 11, 14 and university students on computerized tasks in the domains of biology and geography, where participants used the computer to test the effects of different variables on a particular dependent variable eg. water, light, size of pot on plant growth. The results of their correlational analysis of intellectual ability, metacognition and learning performance found a high correlation between these factors. By partialing intellectual ability they performed semi-partial correlations to find the contribution of metacognition to learning performance. For their youngest three age groups they found that metacognition significantly contributed to learning performance, but not so for university students. Their results led them to conclude that metacognition is a general factor related to the individual rather than domain specific. However, their conceptualisation of metacognition was of metacognitive skill and this may still only be one metacognitive process linked to problem solving, rather than a general process, responsible for monitoring and controlling the whole of cognition.

It is not clear to what extent the UK national academic tests at the end of key stage 1 require metacognition or what type of metacognition. It is possible that metacognition correlates with academic performance on only some types of tasks. However, this study is too small in scale to make those generalisations. It is also possible that methodological problems of measurement are confounding these results.

One interesting finding is the correlation between metamemory and language and theory of mind and language. This finding parallels the research of Thorpe and Satterly (1990), who also found a link between language ability and high scores on tests of metacognition. Their research however, was concerned with verbal language ability, whereas the academic test here is concerned with written language ability. There may still be some overlap between these two media and verbal language ability is explored further in chapters 7 and 8.

7 SUMMARY

This chapter reported quantitative and qualitative analyses of data derived from four tests of metacognition: self as learner, metamemory, theory of mind and mental rotation. The aim was to answer two broad research questions:

1. Can metacognitive ability be enhanced ?
2. Are metacognitive gains related to cognitive/academic gains ?

Question 1 encompassed questions around the nature of metacognition itself. Is it one construct or many different ones? What is metacognition for very young children? How can metacognition be measured ? Question 2 concentrated on whether performance on metacognitive tests correlates with performance on Piagetian tests of conservation, with a spatial awareness drawing test and with UK national curriculum academic tests in language and mathematics.

Results of the four individual tests of metacognition administered to 21 experimental school children and 16 control school children were produced for each test. Chi square tests explored whether the CASE@KS1 project had significantly enhanced the metacognitive ability of the experimental school children above the control school children. The results of the Self as Learner test suggested that whilst children developed metacognitively in this area over the year the CASE@KS1 project had no greater influence on this development than the normal primary school learning environment and maturation.

Results of the interpretative theory of mind test showed a qualitative difference in reasoning and the explanations given by the experimental group compared to the control group. As this test was not administered at the start of the year it was not possible to say what influence the CASE@KS1 intervention had.

The metamemory test showed a greater gain for the experimental group than for the control group. It was suggested that the CASE@KS1 intervention had a positive effect on the development of metamemory in the experimental group.

A test of mental rotation was used as an example of problem solving. The aim was to see if children of this age could explain their own cognitive processing in terms of how they solved this problem. Results of this test showed that over the year there was very little improvement in the children's explanations of how they solved this problem. The chi square results showed no significant difference between experimental and control children.

This chapter also explored the construct of metacognition itself. Results of the four tests were subject to correlational analysis to determine whether they were testing one general factor of metacognition or several different factors. Results of the correlation suggested that the four factors of metacognition tested were in fact distinct and separate items. Children who scored highly on one test did not necessarily score highly on the other three.

In order to explore further the construct of metacognition in terms of children in year one classrooms, the test data were subject to a phenomenological analysis. Rich descriptions produced by this method gave a valuable insight into how children of five and six years old reflect upon and explain their own thinking. The analysis shows firstly, that children of this age are capable of metacognitive processing and secondly, that they describe not only what they know about their own thinking, but also what they feel about different aspects of thinking. The phenomenological analysis helped to define metacognition for this project, as knowledge of cognition, feelings about cognition and the active process of monitoring and controlling cognition.

This chapter has investigated the use of tests to measure metacognition. In doing so issues of validity, reliability and consistency have emerged. Achieving tests of metacognition that can be used with this age group has proved difficult. As the construct of metacognition appears to involve different factors rather than one general one, standardised and age-related tests of specific areas of metacognition need to be developed.

The final section of the chapter sought to explore the extent to which metacognition is related to cognition and to academic performance. Again methodological issues of test measurement were confounding variables. However, a correlational analysis of metacognitive gains on three of the four metacognitive tests and cognitive gains as measured by the main CASE@KS1 project were carried out. Metacognitive scores and scores of academic attainment from national tests taken a year later were subject to Spearman rank correlation. The results of both these analyses showed no significant correlation between metacognition and cognition and between metacognition and academic performance.

The results of this chapter show that whilst metacognition can be enhanced in specific areas such as metamemory, other aspects of metacognition may develop automatically given a normal primary school environment. Different aspects of metacognition appear to develop differently and whilst some aspects may be useful in some areas of cognition, it is by no means clear from these results what the connection between metacognition and academic attainment is.

The next chapter looks more specifically at metacognition and learning. In order to do this metacognition needs to be observed in a classroom setting. This chapter has produced a working definition of metacognition for this project and informed by the phenomenological descriptions from the children these findings are carried over to and inform the observational method used in chapter 7.

Chapter 7

METACOGNITION IN THE CLASSROOM

1 INTRODUCTION

A row of flower paintings is drying on a washing line across the classroom. In the far corner three small children wearing large headphones are listening to audio stories, whilst two others read picture books and squash onto the same beanbag. At the large butler sink a group are floating and sinking a variety of things. There is a lot of shouting as one boy scatters plastic counters over the water, some sink and some float. Over in the home corner, last week's shop has become an alter, and three children are dressing it with pretend icons. Two children jostle for space on the computer, which bleeps, groans and plays a tune every few seconds. An assistant is cutting up pieces of felt, whilst another works quietly in a corner with a boy. The teacher's "noiseometer", a home made paper device stuck on the side of the white board has been raised again and is now in the red zone. The sun streams in through the large windows onto a group finishing their stained glass window pictures. Their fingers are sticky with PVA, the desks are mottled with multi-coloured fragments of cellophane. Every bit of the walls is covered in posters, writing displays, maths puzzles, alphabet friezes and pictures of animals, plants and shells.

Year one classrooms are colourful, busy, often noisy, creative and potentially confusing places. They bubble over with life, with social interactions, with the minutiae of human activity. Yet however colourful and confusing the year one classroom first appears, it is also a highly structured environment. The National Curriculum, the Numeracy Hour, the Literacy Hour, language support, special needs support, teachers, assistants and voluntary helpers all work within a framework designed to aid the educational development of all the children. Into this structure comes CASE@KS1, which is based on collaborative problem solving and designed to accelerate the cognitive development of the children. The CASE@KS1 project provided a good opportunity to investigate metacognition in year one classrooms. The CASE@KS1 project has metacognition as one of the five pillars, which form the structure of all case tasks. If teachers follow the CASE@KS1 programme they should be seeking to facilitate metacognitive processing during the collaborative problem solving CASE activities. In addition, the National Numeracy Strategy, which is put into practice as the numeracy hour in primary schools, includes a period of reflection on what has been learned at the end of the lesson. Teachers are encouraged to ask pupils how they worked out their answers, in order to promote reflection on their thinking processes.

The aim in carrying out observations of CASE and numeracy hour lessons in the experimental and control schools was to answer the following research questions, which arose from the main research question 3:

Q3: How is metacognition facilitated in year one classrooms?

a) Is metacognition apparent in year one classrooms?

b) What do teachers do to effect metacognitive processing in their pupils?

c) Are teachers successful in provoking metacognitive responses from pupils?

d) What other variables affect the development of metacognition in year one classrooms?

This chapter, firstly discusses general issues arising from the observation method and relates these to the specific issues of observing in year one classrooms; method, content, frequency, recording and relationships are discussed. Secondly, the specific aspects of CASE@KS1 activities and numeracy hour lessons are described. In particular, in terms of CASE tasks, collaboration, group work and problem solving are important aspects of the programme. The numeracy hour also includes whole class and group work sessions and these two structures are discussed. Thirdly, a method of analysis of the observations is presented. This new method is based on both the theoretical model of metacognition developed by Flavell (1979), to form categories of children's metacognitive behaviour and on a grounded approach which uses the transcribed observational data to form categories of teacher behaviours that facilitate metacognition. Examples of these categories as present in the data are given and explained.

Section 5 presents a small quantitative element, in the form of frequency counts of teachers' behaviours aimed at facilitating metacognition, (hereafter called teacher FM behaviours) and children's metacognitive behaviours, (hereafter called child

M behaviours) as categorised above. Frequency counts of these coded behaviours were made for both CASE tasks and numeracy lessons in experimental and control schools. This gives a general indication of how much metacognitive behaviour is going on in these lessons. An analysis by category shows which aspects of metacognition are most frequently employed in which lessons.

Section 6 provides examples of excerpts from CASE tasks and numeracy lessons, illustrating the interaction between teachers and children in terms of metacognitive behaviours. This analysis is discussed in terms of the possible variables that are impacting on these behaviours.

2 OBSERVATION METHOD

Pilot observations for this project, (see chapter 4) undertaken in schools, which were not part of the main study, raised a number of issues. These can be generalised to the use of observation, as a method for collecting data for educational research. These centre around a) the effect of the observer on the observed; b) what to observe; c) how often to observe; d) how to record the observation; e) how relationships between the various participants develop over the observation period; f) how to interpret and analyse the findings.

2.1 Observer/observed

> "When the observers are physically present and
> physically approachable the concept of the observer
> as non-participant, though sociologically correct is
> psychologically misleading" (Gussow, 1964)

This proved to be the case in the classroom observations for this project. Whilst originally, I sought to be a non participant observer of a group of children, working with their teacher, on a CASE@KS1 task, or working as a group in a numeracy lesson, without the teacher, it soon became obvious that the above statement was true. Simply sitting at, or near a table, with a group of children renders you a "helping adult". In the CASE tasks this was not so noticeable, because the teacher was present and she obviously took precedence over a "visiting adult". However, in the non-CASE observations, it was impossible not to engage with the children to some extent. They asked for help or sought to engage me in conversation or asked my opinion about minor disputes around the table. By the time of the observations, I had already met all the children I was observing, during the pre-intervention testing period. Undertaking the four tests, (chapter 6), with each child individually, had led to some kind of relationship with them. Each child would already have some opinion of what I was like and what I might do for a job. In turn, I must have formed some impressions of each individual child, eg. that this one is shy, or that one is very chatty. Thus, it seems likely that, when observing the groups, the children would relate to me based on their earlier impressions. I had to become aware of my impressions of the individual child, in order to bracket them and understand how they might have affected my observation of the group, for instance paying more attention to one child rather than another.

> "The researcher should not waste time trying to eliminate "investigator effects" instead she should concentrate on understanding those effects"
> (Hammersley & Atkinson, 1983)

During the observation year, field notes were made about some of these interactions between the children and myself, in order to enable me to reflect on the role of observer and to keep track of changes in relationships. This becomes important when seeking to untangle the various variables involved in a year one classroom.

2.2 What to observe

The observations for this project were focussed observations. In the experimental schools, the CASE groups organised by the teacher, consisted of six children in schools B and C, five children in school D and by Christmas, of the intervention year, only four children in school A. There was also a slight drop in numbers in the control schools. School X had five children in my focus group, as did school Z and school Y had six children. The observations were focussed on these small groups. These were the same children that were tested at the beginning and end of the intervention year. In the experimental schools, the groups were observed doing CASE@KS1 tasks with their teacher and were observed during the numeracy hour. In the control schools the groups were observed during the numeracy hour. Within this structure, the observations concentrated on trying to identify any aspects of metacognition and the context in which these happened. Whilst most attention was given to children's speech and verbal interactions with each other and with the teacher, some non verbal cues were recorded, when these seemed significant. After a while, it became it easier to judge that someone was bored or had switched off from the task. Sometimes this could be related to dynamics within the group, but at other times it was more difficult to understand why this had happened. In addition to this focussed observing, field notes were made on the more general aspects, such as the classroom environment; what had happened just before the lesson; what was about to happen after the lesson and the number and type of interruptions during the lesson. Field notes were made about developing relationships between myself and the participants, about my perception of the school as a whole, interactions with other teachers and head teachers and reflections about how teachers and children perceived my role, (see appendix 7.1). These were used to ensure that I was consciously aware of these aspects. They were not usually used in the analysis unless they seemed particularly pertinent to the development of metacognition.

2.3 How often

As this project is located within the larger structure of the CASE@KS1 project, (which involved a team of five researchers), the project directors arranged access to the schools. Restrictions were made to enable all the researchers, engaged on the main project, and on their own individual projects, equal access to the experimental and control schools, without overloading the schools, or becoming too intrusive. So observations had to be carried out during the CASE@KS1 intervention year, beginning in September 1999 and ending in July 2000. The project aimed to be sympathetic to the pressures on teachers and as such there were periods of time when access was not sought, for instance in the last couple of weeks of term, especially the Christmas term, or when staff were out on training or off sick. Consequently, for this project, 48 observations of CASE lessons were made over the year. Each observation lasted between 30 and 40 minutes. In order to lessen the impact on the schools, individual researchers were asked not to turn up for observations too early, or to hang around after the observations, unless invited by the teacher or head teacher. In practice, turning up 5 to 10 minutes before the lesson still allowed enough time over the year to gather field notes on the school as a whole, on the staff room culture, on the relationships between staff and the head teacher and on other staff such as language support assistants and classroom assistants. This all helped to form a broad picture of the organisation and provide a context for looking at important variables in the development of metacognition. In addition to the 48 CASE observations, 12 observations were made of numeracy lessons in the experimental schools and 9 observations were made of numeracy lessons in the control schools. These non-case observations all lasted an hour and tended to end before a recess period, lunch or playtime.

2.4 How to record

During the pilot phase of this project different methods of recording observations had been tried. Originally, an observation schedule was produced, but this was dropped because, whilst it focussed on some important aspects of the lesson, it limited the type of data collected. Whilst this project does not claim to be ethnographic, a return to the literature, especially that of ethnographers, such as Wolcott, Delamont, Hammersley and Atkinson, provided useful and thought provoking examples of recording observational data. Wolcott in particular provides useful strategies for deciding how to look at an event including the paradoxical -

1) look at everything

2) look at nothing in particular

(Wolcott, 1981)

Trying to look at everything, involves making notes about aspects of the classroom which are not restricted to the focus group activity. This was often done before the lesson began, or if there was a prolonged interruption, or sometimes at the end of the lesson, whilst the children were clearing away. As much of the perceived ambience of the classroom as possible, was recorded in field notes. The second instruction, to observe nothing in particular, could also be undertaken in these otherwise empty minutes and as I interpreted the instruction, it involved being in the classroom, soaking up the atmosphere and waiting for something to catch my attention. On one occasion, this was one of my focus group, Sarah, trying to explain to the teacher why she was late for registration and being helped out by another one of the group, Kali. Sarah had comforted Kali in the toilets, because she had been bullied by another child, thus making Sarah late for registration, whilst Kali had made it on time. It was interesting to note this. Would this spirit of co-operation and empathy carry over into the CASE task immediately after registration and if so, would that positively or negatively affect the amount of metacognitive thinking going on in the lesson?

During the CASE group work and the control lesson observations, all verbal interactions between the children and between children and teacher were tape recorded, by placing a microphone in the centre of the group work table. In whole class situations, preceding numeracy or literacy group work, a microphone was placed in the general area of the children. In these lessons, children tended to sit on the carpet as one large group, before splitting into smaller groups. In addition, notes were made, recording some speech verbatim, in case the microphone had not picked up that particular instance and as a marker to aid voice recognition. Year one classrooms can be very noisy and small children can speak very quietly, so it is important to focus on listening very carefully to what is going on and to write down as much as possible, using the tape recording for back up. Video was tried during the pilot phase, but was not used during the main project, because it seemed too intrusive. It also proved difficult to video a group successfully and make notes. Writing is a more normal activity for a classroom, than video, even in the 21st century and so a researcher, sitting with a group of children, making notes, is not as intrusive a presence, as someone filming. In addition, all the children in this project had already encountered me recording them during the four tests and I had at that time explained the tape recorder to them and allowed them to investigate it and listen to their voices. Thus by the time of the classroom observations, the tape recorder had lost some of its novelty value. Notes were made about how the teacher structured the CASE lesson and how the group was controlled. These proved to be important aspects in the facilitation of metacognition and resonated with data from the teacher interviews, (See chapter 9).

2.5 Relationships

Something has already been said about the relationship between researcher and participant. In addition, this observation period also brought up issues around the relationship between the teachers and myself. Such relationships can be problematic as Sara Delamont points out:

> "It is hard to recognize that as a researcher one is a nuisance (at best) and many people in the setting may actively resent, fear or resist one's presence" (Delamont, 1992 p.122).

The roles of observer and observed are beset with problems of power. On the one hand, teachers can feel threatened, or on trial when an observer is in the classroom, yet on the other hand, teachers can take the stance of proving just how difficult and complicated their job is, compared to the observer's job. Perceived status and age of the teacher and observer adds to this dynamic. In some ways a senior researcher may find the dynamic not in their favour, as young or newly qualified teachers may invest them with the role of their college tutors. Novice researchers may come up against experienced teachers, who feel antithetic towards external influence on their practice. In the CASE@KS1 project, an extra dynamic was introduced, in the sense that the project was set up with a team of researchers from the university, in collaboration with the local education authority. The senior researcher, link teacher and project directors were all involved in the professional development of the teachers and in mentoring them through CASE project lessons and providing feedback. My position, as an individual researcher, on one particular aspect of the project, was different. However, the teachers, all new to CASE theory, tended not to make the distinction and at the beginning of the project, I was often asked questions about CASE theory, or expected to provide feedback on the observed lesson. Questions such as "did I do that right?" "I wasn't sure about this bit, do you think it went OK?" etc. were frequent at the beginning of the project. In order to solve this dilemma, I decided to respond honestly to all questions asked, but not to judge or suggest different ways of working to the teachers. Whenever there was an opportunity, I stressed that the purpose of my research was to study the development of metacognition in the children, thus taking the emphasis off the teachers. At the beginning of the project, three of the teachers seemed rather more hostile to my presence, than did the others. Ironically, by the end of the project, I felt I knew these teachers better than the others and by that time some kind of friendship had grown between us. The development of relationships with teachers during a research project is a process based on several factors:

1) Conduct - the obvious things such as keeping to the arranged schedule for observations, waiting to be invited into such places as the staffroom or assembly and leaving promptly, so that the teacher's time is not taken up with chatting about the researcher's business, unless the teacher wishes to.

2) Status – remembering that as a visitor to someone else's working environment, it is not appropriate to comment on that environment. Status also involves whether you are seen as an expert or not. It would be disingenuous to pretend that you know less than you do about something. In order to develop an honest relationship

with research participants it seems best to be clear about your level of expertise in a particular area, but not to generalise this to all areas of education, and not to provide opinions on other educational theories.

3) Role – the researcher should make their role clear and frequently refer to the purpose of their research. Questions should be answered honestly, but one needs to take care not to influence the teacher's practice and thus the project data.

4) Friendship – as most educational researchers will have worked in education in some way in the past, it is not unlikely that friendships with research participants will form, based on a shared understanding of the work or training. Friendships can be helpful to the project, in that the teacher in question begins to relax and act more normally in the researcher's presence. However, they can also cause problems, if the teacher begins to see the researcher as a "co-conspirator" in the project. In order to counter this, it is important to let friendships develop as naturally as possible, based on shared experience, other than in the educational field. It is best then to chat about things other than the project and to get to know the teacher as a person, rather than as a teacher only. It is important to keep in mind the end of the project and the researcher leaving.

5) Concern – the researcher should take responsibility for the feelings the project is producing in the participants and seek to minimize any negative fall out from the project. Trust, based on scrupulous regard to confidentiality tends to make participants feel safe with the project and minimizes negative feelings.

6) Respect – the participants should be informed about the outcome of the project and provided with copies or references to the published material.

These general points have emerged from the experience of observing in classrooms for this project.

Relationships with the children, as research participants, were also maintained with regard to the above points, where appropriate, and with a greater concern and reflection on the issues of power in the relationships.

3 GROUPS AND TASKS

3.1 Group work

One aspect common to both CASE@KS1 tasks and the numeracy hour, is the idea of group work. However, this is conceptualised differently in each case. In the CASE@KS1 tasks the aim is for a group to collaborate, to solve a problem based task, with the support of the teacher. The teacher's role is to facilitate the smooth running of the group, to lead the task through the CASE structure (the five pillars) and to offer direction, if the discussion should falter. Thus the whole CASE@KS1 activity is conducted as group work. The numeracy hour format usually consists of a whole class introduction to the topic, mostly taking place on the carpet. The teacher leads, asking questions of individual children and explaining the mathematical content. This usually takes about fifteen to twenty minutes and then the children go to their group tables to work on examples of that day's topic. Whilst seated together these children may sometimes be working in pairs or individually. During observations for this project, the children were never asked to work as a group of more than three, although they did all spend some time talking to others on their table, either about the task, or just socially. During this group work period, the teacher tended to move around the classroom, visiting each table in turn for a few minutes, or she sometimes became engaged with one group for longer.

In the CASE@KS1 programme, three tasks at the beginning of the year are specifically designed to encourage working together, listening and communicating skills. A great deal of research has been done into group work and there is a general consensus that groups need time to become effective and that some kind of training in working as a group is necessary (Bennett & Dunne, 1990; Galton & Williamson, 1992; Hockaday, 1984; Kutnick & Rogers, 1994). Hardman and Beverton (1993), go even further, in suggesting that to work effectively as a group, pupils need to be made aware of what they term "metadiscoursal" skills These include showing children how to question or challenge, how to listen and take a positive interest in the group, skills of turn taking, including yielding a turn and holding the floor, the use of discourse markers such as "well", "I think" and paralinguistic features.

A distinction needs to be made between co-operative group work and collaborative group work. Galton & Williamson, (1992), define co-operative group work as when children are allocated individual tasks as part of a group project. The project comes together at the end when the individuals contribute their own piece to the project. Collaboration involves all the children working towards a single outcome and producing an agreed solution through discussion and sharing of ideas. The task then must also be suitable for collaborative work; it must require multiple perspectives and have the possibility of different solutions, (Kutnick, 1994).

3.2 Group Formation

Research on the formation of groups for collaborative working has highlighted the importance of taking into account various variables when forming the groups, (Bennett & Cass, 1989). These include group size; level of ability; friendships, age, personality and gender. There is no definitive answer to the question of what the most effective make up of a group is. For the CASE@KS1 focus groups, the teachers were asked to form groups that were moderately mixed, in terms of attainment levels and gender. Heterogeneous/mixed ability groups have been found to work most effectively on problem solving tasks and to make use of more elaborate interactions, (Slavin, 1990; Webb, 1991). Friendship grouping is problematic, with some research showing it to have a limiting effect on group effectiveness (Webb, 1991), whilst other research has shown it to be advantageous (Hockaday, 1984). Groups of six were chosen, as experience had suggested that this was a good size for collaborative work and it worked practically with classes of 30 children, (Adey, 2002). The numeracy hour groups were slightly more problematic, as the tendency is for teachers to group children in numeracy by attainment level. The experimental school teachers were asked to keep the CASE focus groups together for numeracy during the year. The control school teachers were asked to form a moderately mixed group of six children that would be kept together in numeracy for the year, to form a focus group for this research. All the teachers participating in this research seemed happy to comply with this and kept the focus groups for this project together, for the year, in these lessons.

3.3 The Tasks

Task type and task structure has been shown to have an effect on the ability of a group to work collaboratively, (Yager, Johnson, & Johnson, 1985). King, (1991) and Meloth & Deering, (1994), showed that children who were made aware of task structures and given models of how to ask questions, developed better metacognitive awareness, when measured on post intervention retention and task comprehension, than students who were simply allowed to work co-operatively.

In addition, group interactions have also been found to be affected by the type of task, (Cohen, 1994; Webb, 1985). Some tasks while seemingly appearing to be collaborative work, really only require sharing of information or dividing up of the work into individual tasks. Other tasks require high levels of collaboration, including the metacognitive elements of planning, evaluating, choosing strategies and checking. The CASE@KS1 tasks are of an elaborated problem solving structure, designed to provoke intellectual stimulation, facilitate collaborative working and provide "metacognitive experiences" as delineated by Flavell, (1979).

The tasks given during the group work period of the numeracy hour varied. Sometimes these involved worksheets, which were to be completed individually, but could involve collaboration as a pair. Other tasks involved two or three children working together to produce one completed project, for instance a bar chart or a diagram of how different coins can be combined to make a particular amount. Observations of these periods showed that quite often, when asked to work together in this collaborative way, one child did most of the work. Sometimes the tasks seemed easier to do together, but at other times they seemed easier to do alone. For instance trying to draw around coins on one piece of paper really involves taking turns and sometimes this meant one child taking more turns than the other.

3.3.1 CASE@KS1 Tasks

The 26 CASE@KS1 activities, now published as "Let's Think"! (Adey et al., 2001)), are grouped into four of the schemata identified as forming concrete operations in Piagetian developmental theory, (Piaget & Inhelder, 1969). The schemata used are seriation, classification, point of view and causality. Within a schema each task is structured by the pillars of CASE theory, (Adey & Shayer, 1994). These are: concrete preparation, cognitive conflict, social construction, metacognition and bridging. For this project, the teacher working with a group of six children, must structure the activity using these pillars, whilst facilitating collaborative working, to achieve a consensual agreement to the problem.
CASE theory has described the case pillars as follows:

Concrete Preparation:	Introduction to the problem
	Context
	Introduction to materials and vocabulary needed
Cognitive Conflict:	Intellectual challenge
	Difficulty geared to Vygotskian theory of ZPD with support provided by the teacher
Social Construction:	Discussing ideas within the group
	Asking for explanations
	Describing own ideas
Metacognition:	Becoming conscious of one's own thinking
Bridging:	Finding other contexts within which the schema can be used
	(Adey et al., 2001)

3.3.2 An example of a CASE@KS1 task:

Schema: Classification
Task : Clowns
Timing: Spring Term

Material:
6 base pictures of clowns
6 pairs of shoes, pairs of gloves, trousers, badge, bat and bow tie of different colours
6 pairs of shoes, pairs of gloves, trousers, badge, hat and bow tie of different patterns

Task:
For each child to dress a clown so that none of his clothes have the same colour or pattern.

CASE@KS1 activities aim to facilitate metacognition through the interaction of particular tasks with the other key aspects of the CASE programme, such as collaborative group work and CASE pedagogy.

Whilst CASE@KS1 activities are structured around the above pillars, it is clear when observing a real group in action on a CASE task, that the pillars overlap. Observations throughout the year and subsequent analysis of those observations, sought to tease out the metacognitive aspects of a group working on a CASE task, from other aspects and to come to some understanding of how the dynamics of the group, within the larger classroom structure, impact on metacognitive processing.

4 ANALYSIS OF OBSERVATIONS

Initial readings of the transcribed observations showed that at this age (5-6yrs), the majority of the interactions were between teacher and child/children. When the children interacted with each other, they did so, largely in terms of themselves, making statements beginning with "I". Interactions between children and children were also largely in the form of "I" as in "I don't understand what you are saying".

Based on these initial observations, a coding system was developed using two methods. Firstly, the need to identify the children's metacognitive statements led to a theory based approach. The theory was derived from Flavell's description of metacognition as involving stored metacognitive knowledge, in the categories of person, task and strategy variables and monitoring and control aspects, in the form of metacognitive strategies/actions.

Flavell suggested that metacognition comes about from the interaction of metacognitive knowledge, metacognitive strategies and metacognitive experiences. Metacognitive experiences are:

> "any conscious cognitive or affective experiences that accompany and petain to any intellectual enterprise"
> (Flavell, 1979)p.906

This would include, for example, both fleeting feelings of incomprehension and lengthy dwelling on a feeling of puzzlement.

It seems clear from Flavell's theory that provoking metacognitive experiences through engaging children in novel situations that require a great deal of thought, including planning and evaluation, is likely to lead to the development of stored metacognitive knowledge and the ability to monitor and control cognition through metacognitive strategies.

The analysis of the classroom observations sought to identify any of these aspects of metacognition, as they are shown in the children's verbal behaviour, during a problem solving activity. Thus, the following coding system was developed to label these different categories of metacognition.

4.1 Coding of Children's Metacognitive Behaviours (M Behaviours)

Table 7.1 Child M Behaviours - Codes

Metacognitive Knowledge

Person Variable

Code	Explanation	Example
SELF	Shows knowledge of self in relation to cognition	"I know what to do" "I love hard work"
OTH	Refers to what others think/desire	"She doesn't know" "He doesn't want to be last"
UNIV	Refers to universals of cognition	"We've got to solve a problem"

Task Variable

UND	Questions task information	"Something is missing"
PRED	Predicts success/failure	"We'd be done in a minute"
RAT	Refers to ease/difficulty	"This is so hard to do"
COMP	Compares with other tasks	"This is like the stairs one"

Strategy Variable

EVA	Evaluates: indicates knowledge about what might be useful	"We should build up the boxes, that will be quicker"
PLAN	Refers to planning the task	"We need to know which way to go round the table" "We should talk about it together"

Metacognitive Strategies/Actions

PAR	Paraphrases to confirm understanding	"Did you mean ….?"
SQU	Asks a question of self	"I think that's right, is it?"
CHE	Checks work	"This one's good, this one's not"

To help to answer the question of "What teachers do to facilitate metacognitive processing in their pupil", the transcribed observations were searched for any aspect of teacher verbal behaviour that could be categorised as aiming to facilitate metacognition. Twelve categories of behaviour were identified from the transcripts and labelled as follows:

4.2 Coding of Teacher Facilitating Metacognitive Behaviours (FM Behaviours)

Table 7.2 Teacher F M Behaviours - Codes

Code	Explanation	Example
TS	Refers to self-learning strategies	"What could you do if you've got problems?"
TK	Questions acquisition of knowledge	"How do you know that?"
TI	Seeks information	"What are you going to do now?"
TE	Aids explanations	"X explained how she has sorted these into colours"
TQ	Questions, comments on, or asks for explanations of strategies	"Why did you do it like that?"
TP	Asks for predictions of success	"Will this work?"
TL	Shows expectations of planning	"How are we going to do this, what do we need to think about?
TO	Expects checking	"Check what you are counting in"
TC	Refers to own cognitive processes	"I don't understand it either"
TT	Refers to cognitive processes in general	"We all need to think really hard about this"
TU	Refers to universals of cognition	We are going to solve a problem
TV	Prompts evaluation	"Was it difficult to do or was it easy?"

Two points need to be made about this type of qualitative research. Firstly, compartmentalising verbal interactions in this way is artificial. Boundaries are drawn around the categories by the researcher, but in reality some categories may overlap. Coding is a tool that allows large amounts of data to be organised and managed and the same data can be coded in different ways depending on the research question. In this case, only examples of metacognitive behaviours are coded, although notes were made about other aspects of the class. The second point to note is that the categories are interpretations of verbal behaviour. They have been interpreted as facilitating metacognition, because they ask questions that require one to think not about the solution to a problem, but about how to get to that solution, or to reflect on one's own feelings of knowing something, or to become conscious of thinking about something. Sometimes, it is only clear from the context of the individual speech act that the teacher is engaging at a metacognitive, rather than cognitive level. For instance a simple question taken in isolation such as "how did you do that?" could be referring to the cognitive strategy used to solve a problem and the answer might be "we put the biggest here and the smallest here". But, "how did you do that?" could also be metacognitive if it refers to the metacognitive strategy. In this latter sense, the question is a short form of asking, "how did you know how to do that?" This may get an answer referring to past knowledge or to an analogy, "because it's the same problem as the sticks" or a more general answer, "I had to think about it and decide how to organise it". A critic may suggest that these two questions are sufficiently different to be obvious in the text, but in reality, people are not nearly so precise with language and meaning is often conveyed by stress and tone, rather than a change of words. Sometimes, of course, the meaning will not be conveyed accurately and a teacher, believing themselves to be asking questions that provoke metacognitive thinking, may in fact be getting either rote answers, usually beginning with "I think" or answers on the cognitive, rather than metacognitive level. Inter-rater coding of a sample of six observations by three coders at different times produced 95% agreement. Coding erred on the side of caution with disputed areas not included in the final analysis.

There are two basic types of FM behaviour that the teachers engaged in. One is asking questions with a metacognitive element to them or making statements with a metacognitive element. Table 7.2 gives examples of both questions and statements. The second FM behaviour and one that is still coded using the twelve category system is that of modeling the behaviour required. A good example of this is shown in the extract below:

4.3 School B CASE task –Buttons, Autumn Term

Towards the end of the task the children are coming to some agreement about how a variety of buttons should be sorted out and put into order:

275: Andre: Oh these have got squashed up together, but we've got no more to

276: go with it, so we could squash them up together, ...[continues at some length]

277: *Teacher: I don't think I'm following what you're saying.* TC

278: *Andre: I think we should squash them all together because these are all*

279: *squashed together*

280: *Fumi: Why do they have to be stuck together ?*

281: *Teacher: I don't understand why they have to be stuck together ?* TC

The example is presented not as an example of children explaining their thinking behind their actions, but as an example of the teacher modeling the behaviour of not understanding. By participating in the group on a level with the children and speaking of her own incomprehension of Andre's explanation, the teacher models good metacognitive behaviour and this allows Fumi to ask the question that has been bothering her and, it turns out, other members of the group also.

Whilst the four teachers in the experimental schools tried hard to ask questions which would facilitate metacognition, modeling behaviour was a much rarer occurrence. This contrasts with how teachers were observed to model other behaviour for their young students, especially social skills, - listening to others, treating each other with respect, not shouting, not hurting each other. It is clear that, with the notable exception of the School B teacher, the teachers of both control and experimental schools, rarely refer to their own thinking processes.

5 RESULTS

5.1 TEACHER F M and CHILD M BEHAVIOURS

Frequency counts of child M and teacher F M behaviours were made for all CASE activities observed and all numeracy lessons observed in both experimental and control school, (see appendix 7.2). These instances of metacognitive behaviour were totalled for the year for both CASE lessons and numeracy lessons in the experimental and control schools. There were many more observations made of CASE lessons than numeracy lessons in both experimental and control schools. Thus the total number of child and teacher behaviours recorded over the year was divided by the number of observations made, to give an average number of child M and teacher F M behaviours for each school, (Table 7.3 below). This count revealed that one experimental school (school B), had consistently high counts for both teacher F M and child M behaviours, and one control school (school Y), had consistently low counts for both types of behaviour.

Table 7.3

Total number of teacher F M and child M behaviours, observed

School	No. of obs	Teacher F M Behaviours	Average	Child M Behaviours	Average
A Case task	12	184	15	104	8
B Case task	12	157	13	196	16
C Case task	12	100	8	74	6
D Case task	12	204	7	122	10
A numeracy	3	31	9	24	8
B numeracy	3	36	12	27	9
C numeracy	3	22	7	6	2
D numeracy	3	39	13	11	3
X numeracy	3	25	8	39	13
Y numeracy	3	7	2	15	5
Z numeracy	3	32	10	27	9

Spearman Rank Correlation was carried out on the frequency counts of the teacher F M and child M behaviours for 48 CASE@KS1 activities in the four experimental schools. This would indicate if the teacher F M behaviours observed during these 48 tasks correlated with the child M behaviour observed during the same tasks.

The positive correlation of 0.453 is significant ($p<0.01$). This supports the prediction that teacher FM behaviours and child M behaviours in CASE tasks are positively correlated.

Table 7.3 shows that Control school X had the highest count for child metacognitive behaviours in numeracy lessons and had a relatively high count for teacher F M behaviour in these lesson. However, further analysis by code (see appendix 7.2, tables A.7.16 and A.7.30), revealed these counts are made up from high scores in few categories. The teacher F M behaviours tended to be coded as TQ, which is teacher questioning, and asking for explanations for strategies used. This may not always lead to metacognitive answers. Whilst the teacher may be asking these questions to provoke thinking about how strategies were arrived at, the answers were often descriptions of the strategy used. Control school X failed to score in six child metacognitive categories and the relatively high total score is again made up of a high score in one particular category EVA. This indicates children evaluating a strategy they are using.

Inspection of the frequency counts in the control schools numeracy lessons revealed that the high counts are frequently a product of repetitive prompts of the same kind by the teacher, (appendix 7.2, table A.7.16). One limitation of this method of frequency count analysis is that high scores may be made from repetitive behaviours, rather than qualitatively different behaviours. Thus further analysis is always needed to understand what the prompts are. It is possible for a low frequency count to reveal a broader and arguably, qualitatively better range of metacognitive behaviour than a higher count of repetitive behaviours. Thus the frequency count analysis can only be used as a starting point from which to explore the data using qualitative methods. However, it is interesting to note the categories of teacher behaviour, which are most frequently and least frequently used in the experimental and control schools.

5.2 TEACHER F M BEHAVIOURS

Frequency counts were made of the numbers of teacher behaviours coded, as described in table 7.2 above. These frequency counts were made for each CASE activity observed over the year, (see appendix 7.2 tables A.7.4-A.7.15). Similarly, frequency counts were made of teacher behaviours coded and observed during numeracy lessons in the experimental and control schools over the year. (See appendix 7.2, tables 7.16 and 7.17). The teacher F M behaviour categories with the least number of instances overall in experimental and control schools during numeracy lessons are:

TS – refers to self-learning strategies

TI – asking for information

TE – aids explanation

TP – asking for predictions of success

TL – shows expectations of planning

TO – expecting checking

TC – refers to own cognitive processes

TU – refers to universals of cognition

(See appendix 7.2, table A.7.36).

These results show that whilst there can be a relatively high number of teacher F M behaviours counted over the observation period, these may be a result of a limited range of metacognitive behaviours being repeated. Out of the twelve categories delineated and counted, eight categories had scores of less than 10 instances of that particular teacher F M behaviour during the year in numeracy lessons. As many more observations were made of CASE lessons than numeracy lessons over the year, it is difficult to make comparisons. However, the teacher F M behaviour categories with the fewest instances in CASE lessons for all four experimental schools, over the year were, TS, TI, TP, TO and TU. (see appendix 7.2, table A.7.17) All these categories had less than 20 instances over the year. It appears that these categories score low instances of teacher F M behaviour in both numeracy lessons and in CASE tasks.

The categories with the most number of instances overall in both the experimental school CASE lessons and experimental school numeracy lessons are also the same categories that score highest in the control school numeracy lessons. These are:

TT – refers to cognitive processes in general

TQ – questions, comments on or asks for explanations of strategies

TK – questions acquisition of knowledge

TV scores over 10 in the control school numeracy lessons, but is a less frequent aspect of teacher F M behaviour in experimental school numeracy lessons, (See appendix 7.2, table A.7.36)

It is, perhaps, unsurprising that these three categories had the highest frequency counts in the experimental schools, as these are the aspects of facilitating metacognitive development most often referred to during CASE@KS1 professional development days. Teachers are encouraged to ask questions such as "How do you know that?" (TK); to ask for explanations of strategies used "Why did you do it that way?" (TQ) and to make reference to thinking processes throughout the task – "We all need to think about this" (TT). The teachers are also asked to ensure that at the end of the lesson, the children reflect on the task (TV). However, whilst this appears to happen in the CASE lessons, when experimental school teachers transfer to numeracy lessons, they tend not to include this behaviour to the same extent. This may be due to other factors, such as the structure of the numeracy hour, time to reflect at the end of the hour, or the conflict between organising the class for lunch or break time and prompting evaluation of the lesson. However, one control school, school Z, had a high count for this code, (appendix 7.2, table A.7.36), suggesting that she frequently asked her class to evaluate their learning at the end of the numeracy hour.

It is interesting, that although the experimental school teachers were encouraged to refer to their own cognitive processing (TC), in order to act as a model for the children, with the one exception of the School B teacher, the frequency of this behaviour was very low. Chapter 9 seeks further understanding of teacher behaviours through analysis of teacher interviews.

5.3 CHILDREN'S M BEHAVIOURS

The transcripts of the experimental and control schools were analysed and coded into the four categories and twelve sub codes, (see table 7.1). In all cases only the interactions of the focus group children were analysed. In the numeracy lesson observations, the focus group children remained as a group for the middle part of the lesson and returned with the other groups to the whole class session at the end of the lesson. Frequency counts were made of these twelve behaviours for the whole focus group, for each CASE activity undertaken and each numeracy lesson observed, in the experimental and control schools, (See appendix 7.2 tables A.7.18-A.7.31)

The child metacognitive behaviour categories with a year end total of less than ten instances in experimental and control schools during numeracy lessons are:

UNIV – refers to universals of cognition

UND – questions task information

PRED – predicts success/failure

COMP – compares with other tasks

PLAN – refers to planning the task

PAR – paraphrases to confirm understanding

SQU – asks a question of self

(See appendix 7.2, tables A.7.30 and A.7.31)

Thus seven out of the twelve categories have less than ten instances of that particular child metacognitive behaviour recorded in 21 observations of the focus group children, working in numeracy hour lessons. Similarly, but with the exception of COMP and PLAN categories, the other same five categories also recorded the fewest instances of those particular child metacognitive behaviours during CASE task observations across all the experimental schools, over the year, (See appendix 7.2, table A.7.31).

The codes of child metacognitive behaviours with the highest instances across all observations, both CASE and numeracy in the experimental and control schools are:

SELF – Shows knowledge of self in relation to cognition

OTH – Refers to what others think or desire

RAT – Refers to ease/difficulty

EVA – Evaluates

These categories of child behaviour parallel the high frequency counts of teacher behaviours, in the categories, TT, TQ, TK and TV. Teachers engaging in a lot of questioning around the strategies employed (code TQ) generate more child thinking about those strategies. Similarly teachers asking lots of questions about how knowledge has been acquired (Code TK) generate more thinking on the part of the child about themselves as cognitive beings (code SELF). They may also be engaging in questioning themselves in order to answer TK type questions. This would go along the lines of:

Teacher: *how do you know that ?* TK

Child: (pause*) I remember learning it before* SELF

Whether the pause is really filled with the reflective question "how do I know that?" we cannot tell. However, from the high number of instances of children referring to themselves as cognitive beings, we can speculate that given the opportunity, children of this age are able and willing to reflect on their thinking in this way.

In the following extract it is noted that through the teacher's careful facilitation the children engage in the metacognitive process of evaluating and discussing explanations of their thinking process. In addition, Chloe in particular, has a metacognitive experience, when through the group interactions, she comes to understand something about her own cognitive explanations.

5.4 SCHOOL B CASE TASK – BOTTLES

This task is part of the causality schema. At first the children are presented with two small plastic bottles. They contain different amounts of rice. The children have to predict which bottle will roll down a slope. Then they test their predictions. They use their new knowledge of what weight of bottle will roll to categorise the several other bottles into rollers or non-rollers. Finally they test their assumptions. This excerpt comes near the beginning of the task when the children are seeking to predict and explain which of the two bottles will roll.

28. Chloe: *I think he had a reason for it* (referring to John's strategy)
29. *but I don't have a reason I just think the heavy one will roll* OTH
30. Teacher: *what do you think Andre?* TT
31. Andre: (no answer)
32. Oliver: *I think the lightest can go fastest and can go further,*
33. *the heavy can't go so fast because its heavy so it won't go as far.*
34. Chloe: *Oh, I've changed my mind.* SELF
35. John: *I've changed my mind too because I think Oliver's idea is* SELF
36. *better than my idea.* RAT
37. Teacher: *And why do you think that?* TT
38. John: *Because if we have lots of things in it, if it didn't have*
39. *anything it would go really fast and then we wouldn't have to pull*
40. *or push it along.*
41. Joseph: *If it's lighter it will go faster because it's like a ten year old*
42. *and grandpa racing. The ten year old would probably win because*
43. *the ten year old would be smaller and like the light bottle and he*
44. *would be younger and have more strength, so light bottle will go*
45. *further.* COMP
46. Teacher: *Oh that's an interesting idea. What do you think about John's*
47. *idea Andre?* TV

Andre: *I think John's idea is good.* RAT

Teacher: *What do you think about Joseph's idea, is it a good idea that we can compare people running and these bottles?* TV

Andre: *Yes.*

Teacher: *Why do you think it's a good idea?* TV

Andre: *Cos the 10 year old would be skinnier.*

Teacher: *But is the bottle skinnier?*

Andre: *No, it's quite fat.*

Teacher: *Is that really like a grandfather a bottle of rice?*

Oliver: *It is quite like a grandfather.* COMP

Teacher: *How do you know this one is going to go slower than this one then?* TK

Andre: *Because this one has got more rice in it and this one has got less, and the light one goes further up to this end and this one will only go about up to there.*

Teacher: *And how do you know that?* TK

Andre: *This one* (bottle with less rice) *will go up to there and this one* (bottle with more rice) *only up to here.*

Teacher: *How do you know that?* TK

Andre: *Because this one has less rice.*

Teacher: *So what does that mean?*

Andre: *So it will go further.*

Teacher: *Why though? Why does having less rice mean it goes further?*

71. Chloe: *I don't understand this.* SELF

72. Teacher: *He's got an idea, he thinks that the lighter one is going*

73. to go further TE

74. Chloe: *He's not telling us why.* UND

75. Teacher: *Fumi why do you think Andre thinks the lighter one will go* TT

76. further

77. Fumi: *This one is more... heavy one will go further.*

78. Teacher: *Oh is that what you think Andre?* TT

79. Andre: *This one has less and this one has more and this one will go*

80. to here and this one will go about here, might stop in the same place.

81. Fumi: *Yeah, it might go to here.....*

82. Chloe: *The lightest will go further, the heavy one is slower,*

83. I think Oliver's idea is right. RAT

84. Andre: *Yes, Yes*

85. Chloe: *It's like Molly and me when we rolled down the hill and*

86. I was lighter and rolled further. COMP

87. Teacher: *Chloe has used an example of something she has* TT

88. experienced before and she thinks that the lighter one goes further. TE

. . .

5.4.1 Analysis

In this extract, whilst much of the verbal interaction is between teacher and child in terms of question and answer, it also clear that the children are engaged with and responding to each other. This collaboration is facilitated by the teacher as she asks different children to comment firstly on John's idea that the heavier bottle will roll further and then on Oliver's idea that the lighter bottle will go further. The teacher makes it clear that the children should evaluate the evidence given for the claims rather than just the claim itself (Lines: 46, 49, 52, 56, 68). This task takes place in the Spring term and so the group members are practised at working together. John appears to feel safe enough to verbalise his thoughts about his own idea and compare it to Oliver's (Line 35 and 36). This is no mean feat for five year olds to accomplish. In this extract the teacher continuously asks the children to consider "how they know". Yet this is not mere repetition of the same question. The teacher is fully involved in the group process and facilitates the inclusion of all the children in this process, for instance asking Andre to comment on John's idea (Line 46/7) or asking Fumi to comment on why she thinks Andre thinks something (Line 75). Whilst the teacher comments on Joseph's idea (Line 46) herself she also asks Andre to comment firstly on John's idea and then on Joseph's, thereby seeking a comparison between the two ideas. In addition the teacher seeks reasons for why the idea is a good one (Line 52). The teacher has moved the conversation away from the pragmatic level of which bottle will roll further, to a more abstract level of explaining and evaluating the ideas about what might happen. Thus the object of the interactions becomes not the bottles themselves, but thoughts and predictions about the bottles – a first level of metacognition.

If we consider Chloe's contribution, we find a second level of metacognition. Chloe begins by referring to her own thought processing, in comparison to John's (Line 28) *"I think he had a reason for it, but I don't have a reason".* Then in light of Oliver's different explanation, Chloe changes her mind (Line 34). She was never very sure of her first inclination anyway, as we have just seen and she is able to convey this confusion to the group later, (Line 71) and she goes further, suggesting that the reason for her confusion is the lack of a convincing explanation (Line 74). Finally Chloe realises that she agrees with Oliver's explanation (Line 83), because it now fits with her own thoughts and past experiences of heavy and light objects (Line 85). Throughout this extract, whilst Chloe has been largely quiet, she has been engaged in the process of working out her own opinion. The collaborative nature of the group, sharing and discussing ideas and the teacher's careful facilitation of a metacognitive environment has enabled Chloe to work through a "metacognitive experience", (Flavell, 1979).

This analysis shows how the teacher has structured her questioning to facilitate the children in thinking about and evaluating each other's ideas. By doing this, they begin to think about how they are thinking about the problem and which explanation seems most likely, in terms of their own experience and what they have just heard and observed.

5.5 TEACHER F M BEHAVIOUR IN NUMERACY LESSONS EXPERIMENTAL AND CONTROL SCHOOLS

Both experimental and control schools have far fewer teacher F M behaviours during numeracy lessons when compared to CASE lessons. One reason for this may be the structure of the numeracy hours. All schools followed a similar structure with whole class mental arithmetic followed by what is usually called, group work. In reality this tended to consist of children sitting in groups, but working individually or at most in pairs. This was followed by a return to the whole class for debriefing and reflection. This structure means that teachers are less able to model metacognitive behaviour, since for the middle part of the lesson children are working alone and may or may not be visited by the teacher. Secondly, the nature of many of the arithmetic problems the children were working on gave little scope for metacognitive thinking.

The control school numeracy lessons tended to provide teacher F M behaviours in a limited number of categories. These were most often in general references to thinking, in questioning strategy use or in questioning acquisition of knowledge. Planning and checking work were not evidenced nor was predicting success or failure and evaluating learning was only rarely seen, as in the examples below.

There are individual differences between the control school teachers in the extent to which they engage in F M behaviours. Here are two control schools aiming for metacognition at the end of the numeracy hour:

5.5.1 School X Numeracy Hour Autumn Term – Last 10 minutes

118: Teacher: *One last thing before we finish off, did you find*

it easy or difficult? TV

119: Chorus: Easy RAT

120: Teacher: *so what did you find easy about it?* TV

121: Louise: *counting the sides, we learned the numbers*

122: Teacher: *what numbers?*

123: Louise: *we learned it more because we knew the numbers*

124: Teacher: *did you find it hard Drew, what did you find hard*

in the beginning? TV

125: Drew: [stays quiet]

126: Teacher: *what did you find hard Lewis, did you find anything*

127: *hard about sorting them out?* TV

128: Lewis: forgot what shapes go together

129: Teacher: *OK* [asks children to return to the mat where they continue to identify shapes from descriptions of them for last 5 mins before lunchtime]

5.5.2 School Z Numeracy Hour Spring Term – Last 10 minutes

109: Teacher: *Put your hand up if you found the work difficult*

110: [2 hands go up]

111: Teacher: *put your hand up if you found it easy*

112: [lots of hands]

113: Teacher: *put your hand up if you could do the maths today with bigger numbers*

114: [few hands]

115: Teacher: [talks about what will be happening in the rest of the week and children go to lunch]

Whilst both these examples show some attempt at facilitating metacognitive behaviour the school Z teacher relies on a quick show of hands whilst the school X teacher tries to engage the children in reflecting on the work they had just done. However, in both cases the attempts to facilitate metacognition are limited in scope and depth. The tendency is to focus briefly on evaluating individual responses to the tasks, which is a basic level of metacognition, since it involves a reflection on the relationship between individual cognition and a common task. Yet neither teacher was able to extend this. The numeracy hour is, by its nature, content led. The teacher has a scheme of work and a certain amount of material content to get through that term. This, combined with the whole class, group work, whole class, structure makes it difficult to include metacognitive processing. Whilst teachers in both control and experimental schools tried to ask "how" questions, these were largely aimed at the cognitive level, seeking an answer in terms of cognitive strategies used rather than metacognitive strategies aimed, as Flavell said, at monitoring and controlling cognition.

Whilst experimental school teachers used a wider variety of F M behaviours in CASE lessons, this did not transfer to numeracy lessons. Taking all schools together, only school A achieved a similar breadth of teacher F M behaviours in the numeracy hour, and as the frequency count table (appendix 7.2, table A.7.36) shows, some categories in school A have few instances recorded. For the other six schools, the trend was for there to be a zero score in six to nine categories of teacher F M behaviours, (see appendix 7.2, tables A.7.16 and A.7.17).

5.6 CHILDREN'S METACOGNITIVE BEHAVIOUR DURING NUMERACY LESSONS IN EXPERIMENTAL AND CONTROL SCHOOLS

Appendix 7.2, tables A.7.30 and A.7.31 show the frequency counts for children's metacognitive behaviour during the numeracy lessons observed. Control school X has by far the highest count of children's metacognitive behaviours during these numeracy lessons. During the plenary session the teacher usually asked each group to comment on the difficulty or ease of the task and during the group work the children in this focus group often commented to each other on how they were finding the task. It may be that by modelling this behaviour in the plenary sessions, this teacher has provided an impetus for the children to copy this behaviour amongst themselves, when engaged in the group work.

Appendix 7.2, table A.7.35 and A.7.36 shows counts of teacher F M and child behaviours coded as metacognitive during numeracy lessons. The school D teacher appears to engage in a high number of metacognitive behaviours during the numeracy hour (total 39), but the children are not responding in a like manner, (total 11). This means an average of only 3 child metacognitive behaviours per numeracy hour observed, (table 7.3 p.277). Observations showed that this teacher often asks the children how they know something, but the children are often unable to answer or explain. This may be because they haven't developed sufficient language skills to explain their thinking. However, during CASE tasks there was an average of 10 child metacognitive behaviours per observation, (Table 7.3). Thus it could also be, that during the numeracy hour the children are less engaged in thinking about their thinking and more engaged with getting the right answer to the sums. They then find it difficult to switch between the cognitive process of finding the correct answer and the metacognitive process of thinking about how they have done this.

Table 7.3 shows that control school Y had twice as many children's behaviours coded as metacognitive compared to teacher behaviours, (15 child behaviours v 7 teacher behaviours). Further inspection reveals that the children in this group are often talking to other group members during the group work section in terms of themselves, their own ability or their own difficulty with the task. This is also metacognition in Flavell's terms, since it is a reflection on the self as a cognitive being. However, without the intervention of an adult to direct this thinking, it seems unlikely to provide a fruitful line of metacognitive development on its own.

It is also possible that without adult support children could become stuck with unhelpful or biased metacognition about their cognitive ability for certain tasks.

Numeracy hour lessons are structured so that the last part of the lesson allows for feedback to the whole class and for the children to reflect on what they have learnt. It is here, at the end of the lesson, that we would expect to see more metacognitive behaviours. Yet analysis of these observations does not support this theory. Field notes taken at the time show, that more often than not, this return to the whole class period is rather rushed. Children have to physically move, they have not always finished the work at the tables and the end of the lesson usually means lunch time or play time. In this context, it is difficult to see how teachers are meant to engage children in metacognitive processing. The observations show that it can be difficult for year one children to remember what they have just done, let alone how they have done it, once they have moved from the site of the activity.

Secondly, the lack of metacognitive behaviours seen in the numeracy lessons may be a result of the lack of collaborative group work that takes place. Whilst children are sent to "work in your group" in the middle of the lesson, this usually means sitting as a group, but working individually or occasionally in pairs, but even then most often it results in producing individual work. Working in pairs seems to be a shorthand of teachers, meaning that you can talk to your partner as long as the talk is about the work you are engaged in. This appears to be a meaning easily understood by the children.

6 REFLECTING ON THINKING

Referring to thinking in general (TT) seems to be frequently employed by teachers in all the schools. Yet, there are qualitative differences between the way it is used in the experimental and control schools, as the following comparison of a CASE activity with a non-CASE activity in two experimental schools and a numeracy lesson in a control school shows. This example also shows the complex interactions and relationships between the teachers, children and the task in terms of facilitating metacognitive development. These particular examples are chosen because they show how different teachers facilitate metacognition and how children respond to different task structures and ways of teaching.

Example one is from a CASE task

6.1 SCHOOL B CASE ACTIVITY CLOWNS SPRING TERM

There are six children involved in this activity – 4 boys and 2 girls. (Andre (m), Chloe (f), Fumi (f), John (m), Joseph (m), Oliver (m)). The activity is about dressing a clown, whilst following a rule about what he can wear. In this excerpt the children each have a clown. In the centre of the table are sets of clothes such as hats, shoes, trousers in different colours. These children have used this equipment some weeks earlier with a different rule for how the clowns can be dressed. The cognitive conflict in this task usually comes from choosing and swapping items of clothing, ensuring that the children work collaboratively, so that all members of the group end up with a completed clown. However, in this lesson the teacher begins the task by expecting the children to think about what is required and how they might achieve this. This excerpt comes after a period of concrete preparation when the children familiarise themselves with items of clothing, asking questions of each other and all choosing one item, which has to be different from that chosen by anyone else in the group.

6.1.1 Example 1

34.	Teacher:	*Today we're going to dress our clown and he's going to have*	
35.		*a different colour for each bit of his clothing, except for his*	
36.		*gloves and his shoes. Before we start can anyone think of*	*TT*
37.		*any ideas of how we are going to organise this, how we are*	*TL*
38.		*going to do it. Before we start what might we need to think*	*TT*
39.		*about. Joseph what do you think we're going to have to think about.*	
40.	Joseph:	*Taking turns round the table, first Andre takes his turn,*	
41.		*then Fumi, then Oliver, then John, then Chloe, then me.*	*PLA*
42.	Teacher:	*That's very organised*	
43.	Andre:	*It won't be very easy though going round cos you*	*EVA*
44.		*might not know who's after you and you will need the order*	
45.	Oliver:	*I think we should pick the same colour and do different . . .*	
46.		*clothings*	*PLA/EVA*
47.	Teacher:	*Oh*	
48.	Oliver:	*Cos then we will be able to pick all the colours really easily*	EVA
49.	Teacher:	*What does anyone think ?*	*TT*

50.		*Now we've got two different ideas we've got Joseph and*	
51.		*Andre's idea of all taking turns, what was the other*	
52.		*idea Chloe ?*	*TQ*
53.	*Chloe:*	*Er do same colours, I think we should do the same colours*	
54.		*because then it wouldn't be as tricky as it was before*	*COMP/ EVA*
55.	*John:*	*It would be really really easy, we'd be done in a minute*	*PRED*
56.	*Chloe:*	*Yes, we'd be done in a minute*	
57.	*John:*	*And then we could just sit here*	
58.	*Joseph:*	*And wait five hours*	
59.	Teacher:	*Maybe we could do both ways*	*TI*
60.	Oliver:	*How can we do that?*	*UND*
61.	Andre:	*Yeah, I know some could take same colours and*	
62.		*some different colours then it would work*	*PRED*

6.1.2 Analysis

In lines 36-39 the teacher frequently refers to thinking. She asks a particularly interesting question of Joseph: "What do you think we're going to have to think about?" This enables the child to shift his point of view from how he would do the task as an individual to how the task could be done as a group. He presents a strategy, which is then evaluated by Andre (line 43/44). The teacher does not question this but allows a third child, Oliver, to present and explain another strategy and to evaluate for himself how successful that might be (line 45/8). The teacher then facilitates the collaborative process by bringing in other children who have not yet spoken – "what does anyone think" (line 49). She points out that there is more than one way of organising this task, line 50. This gives Chloe the chance to express her thoughts, which she does by evaluating the strategy she prefers in the light of her past experience with the equipment. Line 53-54 "I think we should do the same colours because then it wouldn't be as tricky as it was before". Towards the end of the activity (not shown in the excerpt above) this same child will refer again to her past experience as she evaluates the success and failure of the strategies used. The teacher asks:

188. Teacher: *Why do you think it helps?* [referring to the strategy they have used]

189. Chloe: *Because we didn't have too much muddling, last time we had seven hundred percent muddling.*

In the example 1 excerpt Chloe's evaluation is reaffirmed not by the teacher, but by another child, John – line 55. As the conversation begins to trail off the teacher prompts by giving her own idea to use both strategies – line 59. Oliver is puzzled by the suggestion, but does not sit in silence, he asks for clarification and this is given by Andre, who feels he understands and predicts success for his idea – line 61.

This excerpt continues with the children planning and discussing how they will attempt the task before starting it. The teacher occasionally reminds them of the rule "not the same colours" but otherwise rarely intervenes. The children evaluate each other's ideas. They are expected to think for themselves but also to think about how they can achieve the task as a group. Throughout this excerpt and in the rest of the lesson, the teacher, in combination with the activity, is providing a metacognitive experience for the children. She does this not by continuous questioning, but by becoming part of the group herself. She allows the children to sort out their own ideas in a supportive atmosphere:

36. Teacher: *Can anyone think of any ideas?*

49. Teacher: *What does anyone think?*

The teacher refers to thought processes in a naturalistic way. She indicates she is listening without judging.

47. Teacher: *Oh*

and adds her own idea for evaluation

59. Teacher: *Maybe we can do both ways*

and she allows the children time to think. Her focus in this excerpt is on planning, generating ideas, evaluating and explaining to others rather than on completion of the task. In a relatively short excerpt the quality of the interactions is high, the children are enthusiastic and committed to the task. They are engaged in metacognitive processing, reflecting on their own and others' ideas and evaluating their own understanding.

6.2 SCHOOL A - NUMERACY LESSON.

This example follows the guide lines of the numeracy hour with whole class teaching on the carpet followed by children sitting in groups but working individually with worksheets and then a plenary session for the whole class at the end. Because of this format I have extracted short excerpts from each part of the lesson.

6.2.1 Excerpt 1 Whole class teaching

34. Teacher: *Now I'm going to try and trick you, you have to use your*
35. *brains and tell me what I'm counting in and how many I've* *TT*
36. *counted.* [T counts silently by showing fingers firstly in 2's
37. and counts up to 6]
38. [Children put up hands to answer]
39. Teacher: [does same counting in 10's]
40. Ryan: *six*
41. Teacher: *Is it six? watch again*
42. Ryan: *three*
43. Teacher: *What am I counting in?*
44. Sarah: *tens*
45. Teacher: *Right why did Ryan get it wrong* *TQ*
46. Sarah: *He's not thinking* *OTH*
47. Kali: *He's not counting on* *EVA/OTH*

48. Sarah: *He's not counting in tens* EVA/OTH

49. Teacher: *Yes, I was counting in 10's and so the answer was 30 not 3*

6.2.2 Analysis

In this excerpt the teacher begins by referring to thinking, and indicates the reason for *"use your brains"* L.34/5, so that we don't get tricked. Whilst *"I am going to trick you"* could be an attempt by the teacher to bring an act of deception to the surface and therefore may have a metacognitive intent, it is not clear that the teacher is consciously doing this. At line 45 she asks the children to take on another's point of view and to explain the lack of success. The answers are interesting. The first child, Sarah picks up on the importance of thinking – this must be Ryan's reason for failure, L46. Whereas Kali refers to a failure to use the correct strategy, L47. Then Sarah changes her own idea, maybe it's not a lack of thought only, but a lack of strategy use that causes failure and she adds her own idea L.48 *"He's not counting in 10's"*. The teacher confirms that she agrees and explains why – because *"I was counting in 10's"*. The children are being asked to reflect on someone else's failure and to suggest alternative strategies that may be more successful. Sarah and Kali have the metacognitive experience of feeling they know why Ryan failed.

6.2.3 Excerpt 2

As the teacher sets up the children to work in groups she asks them to reflect on the task in hand

49. Teacher: *Good. That's what I'm asking you to do this morning.*

50. *Use what you know about counting in 2's, 5's, 10's. Check* *TO*

51. *what you are counting in.*

52. Teacher: [Explains work sheets same as board questions]

53. Teacher: *What is the first thing you have to do?*

54. Sarah: *Put date and name*

55. Gillian: *Start work*

56. Kali: *Don't know*

57. Teacher: *Check what you're counting in. I've got 2p's here what* *TO*

58. *should I be counting in*

59. Ryan: *2's*

60. Teacher: [Repeats this with 10p's] [Goes through first e.g. on worksheet]

61. Teacher: [Asks Kali to explain to class what they have to do first] *TE*

62. Kali: *Put date and name, know what you're counting in and*

63. *then put answer in the box.*

64. Teacher: *What could you do if you've got problems?* *TS*

65. Sarah: *Ask teacher* *EVA*

66. Matt: *Use number squares* *EVA*

67. Charles: *Put hand up* *EVA*

68. Kali: *Use hand prints* [on wall showing counting in 5's] *EVA*

69. Teacher: *Any questions before we begin?*

6.2.4 Analysis

In this excerpt the teacher begins by referring to stored knowledge and to checking, line 50/51 and then seeks confirmation that the children have understood, line 53 "What is the first thing you have to do?" She allows the three children, Sarah, Gillian and Kali to have different ideas or to indicate lack of understanding without judgement, lines 54-56. At line 64 she is seeking self-learning strategies and whilst one child Sarah refers to asking the teacher, the other two provide self-learning strategies. At line 69 the children are given the chance to check their understanding of the task and seek clarification before they begin.

6.2.5 Excerpt 3 towards the end of the lesson

93. Teacher:	[Tells everyone to return to carpet]	
94. Teacher:	*What did you find hard?*	TV
95. Gillian:	*I tried* [then tails off into silence]	
96. Ryan:	*I tried to work it out*	SELF
97. Teacher:	*There were a lot of answers wrong because you*	
98.	*didn't check what you were counting in*	*TO*
99. Charles:	*The first one was hard for me there was*	*RAT*
100.	*too many pennies for me*	*SELF*
101. Teacher:	*Did you do it?*	
102. Charles:	*The answer was 12*	

6.2.6 Analysis

In this plenary session the teacher follows the numeracy hour convention of asking children to reflect on the ease or difficulty of the task. She refers again to checking. This repetition from the beginning of the lesson indicates the importance this teacher places on checking for oneself. At L.99/100 Charles' answer is interesting as he reflects on his own performance and shows knowledge of his own cognition, indicating that he knows why he found it difficult:

"There were too many pennies for me"

6.3 CONTROL SCHOOL X - NUMERACY LESSON

Three excerpts have been chosen because of the format of the lesson.

6.3.1 Excerpt 1

1.	Teacher:	*Now get your thinking thumbs ready.*	
2.		[children stick up a thumb] *and I want you to put up*	
3.		*your thinking thumb if you can tell me what is 2*	
4.		*more than this* [T shows a card with no. 4 on it.]	TT
5.		Children put up their thumbs teacher chooses a child in each case	
6.	Drew:	*5*	
7.	Teacher:	*What did you do Drew?*	*TQ*
8.	Child ?:	*She added one*	
9.	Teacher:	*What is one more than* [holds card with 1 on it]	
10.	Lisa:	*one more than one is 2*	
11.	Teacher:	*Two more than* [card with 5 on it]	

12. Denise: *5*

13. Teacher: [repeats question]

14. Denise: *7*

15. Teacher: *10 more than* [card with 6 on it]

16. Louise: *16*

17. Child ?: *That's easy* *RAT*

18. Teacher: *How did you do it* *TQ*

19. Louise: *I added it in my head*

20. T: *10 more than* [card with 17 on it]

6.3.2 Analysis

In this first excerpt of whole class teaching the teacher refers to thinking in terms of "thinking thumbs", she does not refer to thinking as an abstract term or give reasons for thinking. At line 17 a child refers to finding the sum easy, although it was not his question to answer. The teacher does not question his assumption that the sums are easy but asks Louise, who got the sum correct for the strategy used. "How did you do it?". When the child responds with her strategy "I added it in my head", the teacher passes on without comment. The lesson proceeds with the children calculating more sums.

6.3.3 Excerpt 2

This takes place on the carpet a little while later. The children are asked to join three paper coins on the board and total them.

43.	Teacher:	*We are sitting beautifully this morning.*	
44.		[Louise joins up 20, 20 and 10]	
45.		[Class shout out 50p]	
46.	Teacher:	*How did Louise add up her coins?*	*TQ*
47.	Natasha:	*She added up 20, 20 and 10*	
48.	Teacher:	Can *you do it any other way or was that the quickest way*	*TQ*
49.	Natasha:	*That's the quickest way then you don't need to go 10,20,30,*	*EVA*
50.	Teacher:	*Why did Louise choose 20 first*	*TQ*
51.	Natasha:	*Because it's the biggest coin first*	*EVA*
52.	Teacher:	*Yes and that's a good way to add coins, the biggest*	
53.		*first then the smallest*	*TE*
54.	Natasha:	*I know* .... (she is ignored and her sentence trails off)	*SELF*
55.	Bahaki:	[joins up 1p, 2p 1p and says 4p]	
56.	T:	*How did you add it up*	*TQ*
57.	Bahaki:	*2+1+1*	

6.3.4 Analysis

At line 46 the teacher asks for a child to explain from another's point of view and picks up the answer with a question designed to evaluate the strategy, *"can you do it any other way or was that the quickest way ?"* By asking this double question the teacher in effect gives the answer and the child Natasha repeats this, (line 49).

At line 52 the teacher herself evaluates the strategy, when Natasha wishes to add her own idea *"I know .."* she is ignored and the teacher continues with the task.

This third excerpt is from the plenary session when the teacher asks individuals from each table to explain what they have done.

6.3.5 Excerpt 3

147.	Teacher:	*what is the smallest you have made*	
148.	Theo:	*smallest, 4p*	
149.	Teacher:	*How did you make it?*	*TQ*
150.	Theo:	*1,2, and 1*	
151.	Teacher:	*Did anyone make anything smaller*	
152.	Natasha:	*3p. 1,1, and 1*	
153.	Teacher:	*What about the group over here what was your*	
154.		*largest amount?*	
155.	Lewis:	*£2.05*	
156.	Drew:	*£2.05*	
157.	Denise:	*£3.00*	
158.	Natasha:	*£1 and £1 and 5p*	
159.	Teacher:	*Yes you had the pound coins over here didn't you*	
160.	Teacher:	*Drew, how did you make your largest amount*	*TQ*
161.	[Drew has trouble describing how she did it]		
162.	Teacher:	*We will have to finish there for now*	

6.3.6 Analysis

Whilst this session of a numeracy hour lesson is where we would expect to find the metacognitive reflection taking place, it is obvious from this transcript that this does not always happen. Whilst the teacher does ask "How" at line 149, referring to a strategy, the child responds "mechanically" with "1,2,1". Whilst this format of child doing sum, teacher asking how it was done, has been repeated throughout the lesson, the teacher does not go any further and accepts a simplistic answer, thus a possible metacognitive experience, where the child would have to really reflect on their thinking, is lost.

6.4 DISCUSSION

From the three examples of classroom activities shown above it is clear that the CASE lesson (example 1 clowns) and to a lesser extent the CASE school numeracy lesson (example 2) include metacognitive activity of a qualitatively different kind than does the control school numeracy lesson (example 3). In the CASE lesson the teacher engages the children in planning and evaluating strategies, and in thinking about thinking. She asks the metacognitive question "what do you think we're going to have to think about?" She is providing the important role of posing the questions that students will eventually need to ask of themselves when confronted with a problem to solve. The CASE activity provides the framework for this type of questioning; the emphasis is on communication, collaborative working and the process of problem solving rather than the final outcome. Example 2 of a CASE teacher in a numeracy lesson also shows examples of facilitation of metacognition. Here the teacher refers to thinking; she asks the children to reflect on the task and to generate self-learning strategies. She engages the children in thinking about the problems they may encounter and strategies for dealing with them and concludes with the children's reflection on their thoughts regarding the difficulty of the task. In both examples references to metacognitive processing run throughout the lesson. They are not only tagged on at the end as a period of reflection. It can be very difficult for children of this age (5-6yrs) to reflect retrospectively.

The third example from a control school class follows the conventions of the numeracy hour. The teacher speaks of thinking, but here it is reduced to "thinking thumbs". She asks students to evaluate strategies but does not continue the process in any depth, although the children are responding in a "thinking way". Her concern is with successful calculation of number rather than the process of problem solving. This is not to disparage the teacher, rather the context within which she is working puts metacognitive processing to the end of the lesson as a means of reflecting on what has been learnt. This is not only difficult for the children in terms of memory capacity, but also affectively. Young children tire quickly after an hour of cognitive activity, especially when the playground beckons. The teacher too often runs out of time and it is very difficult to achieve any meaningful reflection in the last few minutes when distractions abound.

An important aspect of the CASE intervention is the teacher's ability to model a language of learning. Without a shared communication which responds to the children's attempts to explain their thinking and which encourages them to explore their thinking within the group, it is unlikely that all the children will develop metacognitively. It is likely that as with individual differences in cognition, some children will be more metacognitive to begin with. For some children, early pre-school experiences, or parental interaction may have helped them to think about and reflect on their cognition. For others, who may not have had these opportunities in any consistent manner, developing metacognition may be slower or more difficult. Nuthall has suggested that the learning process is "deeply embedded in, or are, in fact part of the sociocultural processes and structures of the classroom" (Nuthall, 1999)p.244. How children view school and learning will also impact upon their ability to adapt to a more metacognitive classroom.

7 SUMMARY

Results from the frequency counts of teacher behaviours showed that in general in both CASE and non CASE examples, teachers rarely referred to self-learning strategies ie. asking children to consider what they might do if they got stuck on a problem. They rarely asked children to predict whether their method would lead them to success or failure and perhaps surprisingly they rarely referred to checking answers or planning how to solve a problem. On only relatively few occasions did teachers refer to the more abstract "universals of cognition" (Flavell, 1979), for instance, naming the task, "solving problems", or "categorising".

However, both experimental school teachers and control school teachers frequently referred to "thinking" in more general terms. They often asked questions about the strategies being used and about knowledge, beliefs and opinions.

The most common metacognitive behaviours found in the numeracy hour lessons were the more general ones of speaking about thinking, questioning strategies and questioning acquisition of knowledge. There were fewer teacher F M behaviours in the control schools than in the numeracy lessons of the experimental schools, but again there was some individuation amongst the schools. Some factors that were noted which could have impacted on this included an increase in class size at the start of the Spring term as Reception Year children move up into Year One; staffing shortages and changes in school management. In one particular case the class teacher left in the Spring term and was replaced by an experienced long-term supply teacher. These factors are further analysed in Chapter 9.

In CASE activities frequency counts of teacher F M behaviours correlated positively with child metacognitive behaviours. Experimental school teachers were observed to use a greater number of behaviours that aimed at facilitating metacognition during numeracy hour lessons than the control school teachers were observed using. However, in comparison to the types of F M behaviours the experimental school teachers used during CASE tasks, the F M behaviours used in the numeracy lesson were less diverse. It seems likely that the CASE tasks encourage teacher F M behaviours to a greater extent than the numeracy hour. The general trend for the experimental school teachers to have a greater number of F M behaviours observed in the numeracy hour lessons may be due to a transfer of CASE training from CASE activities to other areas of teaching. However, in one category, prompting evaluation, the result was reversed with control school teachers displaying more frequent use of this behaviour. This was observed as being due to repetition of questions around whether the children found the work difficult or easy and tended to occur at the very end of the lesson and often produced simple repetitive answers.

The structure of the numeracy hour showed that it provided less scope for either child M behaviours or teacher F M behaviours, and that attempting to reflect at the end of the hour was difficult for children of this age.

Whilst some teacher F M behaviours such as questioning the acquisition of knowledge seemed to match the child M behaviour of considering their own cognition, other teacher F M behaviours did not match so closely. Further analysis suggested that modeling behaviour was an important factor, not simply asking questions.

A comparison of child M behaviour in the numeracy hour in both control and experimental schools showed that these were similar across schools in terms of frequency and variety. Two factors were suggested which may account for the lack of children's metacognitive behaviours in the numeracy lessons: one was the structure of the lesson and the second was the lack of collaborative group work.

A CASE task, an experimental school numeracy lesson and a control school numeracy lesson were analysed in greater detail and compared in terms of teacher F M and child M behaviours. This analysis suggested, that in these particular cases, the experimental schools displayed metacognitive behaviour of a qualitatively different kind to that shown in the control schools. This behaviour was more complex, deeper and more challenging. The CASE activities appeared to facilitate this by providing a structure which emphasised the process of working through a CASE task together, rather than one which focussed on the outcome. In contrast to the control school teachers, the experimental school teachers were more likely to engage in metacognitive questioning or modeling throughout the lesson rather than in the last few minutes.

Chapter 8

GROUP INTERACTION AND INDIVIDUAL DEVELOPMENT – Three Children Developing Metacognition

1 INTRODUCTION

In much of the UK educational system today children are either pitted against each other in terms of day to day classroom work or are assessed against certain "norms" for their age in terms of end of year or key stage tests. At the same time a vast quantity of educational research has shown that learning is above all a social process. Reference texts for initial teacher training courses still make reference to Piagetian and Vygotskian perspectives on learning. Teachers of young children too, are generally concerned that their students develop good social skills as well as numeracy and literacy skills, (see teacher interviews for this project in chapter 9). Yet the structure of the National Curriculum emphasizes individual achievement and individual assessment. It is still somewhat unusual to find Year One children working together collaboratively to achieve a common goal in many of their subject areas, although there are exceptions, most notably in art, music, sport and drama. The collaboration to achieve a common goal is a fundamental aspect of the CASE@KS1 programme. Learning is here seen as being socially constructed through dialogue, discussion, argument, involvement, risk and emotional content. The CASE@KS1 lessons provide "metacognitive experiences" (Flavell, 1979) for their participants and so we should expect to see some evidence of metacognitive development in the students taking part in the programme.

The previous chapter analysed observational data over the year at group level and explored some of the factors, which accounted for the frequency with which different metacognitive behaviours occurred. This chapter analyses the same observational data to show the impact of the group interactions on the development of metacognition in individual children. This section of the project refers to two research questions:

1) What is metacognition for five and six year olds?

2) How is metacognition facilitated in year one classrooms?

The first question complements the phenomenological analysis of the pre- and post- test data reported in chapter 6; the second question complements the analysis of the teacher interviews reported in chapter 9.

2 CONCEPTUAL FRAMEWORK

In chapter two, in addition to exploring the historical development of the definition of metacognition from different perspectives, evidence from many studies was gathered to show how the development of metacognition has had a positive impact on attainment in different curriculum areas. This chapter however, goes further; it follows Flavell's early research, which suggests that the development of metacognitive processing is also important for the development of the whole person:

> "Perhaps it is stretching the meanings of metacognition too far to include the critical appraisal of message source, quality of appeal and probable consequences needed to cope with these inputs sensibly, but I do not think so. It is at least conceivable that the ideas currently brewing in this area could someday be parlayed into a method of teaching children (and adults) to make wise and thoughtful life decisions as well as to comprehend and learn better in formal educational settings" (Flavell, 1979)p.911

Metacognition develops with age (Flavell, 2000) and with practice (Doran & Cameron, 1995). Interactions with others can provide the stimulus needed for the individual to become more aware of their cognitive processing (Wertsch, 1978). Kuhn suggests that development of theory of mind and metacognitive knowledge can be accelerated by "various forms of scaffolding" (Kuhn, 2000). She goes on to say that while children of four and five years old develop a basic understanding of others as cognitive beings, they tend not to be aware that different people can have different yet legitimate understandings of the same information. This is also borne out in the results of the "droodles" theory of mind test reported in chapter 6. This understanding is what CASE@KS1 tries to develop through exposure to the challenges, views and values of others in the group. It is this aspect of metacognition, along with the development of metacognitive monitoring and control processes, which is likely to have the greatest impact on the development of the whole person not just in a formal educational arena.

This idea is further articulated by a line of research on metacognition which has emphasized the development of the self-system and its correspondence with the development of self-regulated learning (Borokowski et al., 1990; Kopp, 1982; Schunk, 1989). Metacognitive beliefs about the nature of intelligence and individual cognition are, it seems, formed in early childhood through social interaction (Dweck, Hong, & Chiu, 1993), and Thomas has shown how these constructions can then impact on future learning. (Thomas, 2000).

This chapter analyses the effects of providing metacognitive experiences through collaborative group work on the individual development of metacognition. In particular, it asks how do individual children experience the metacognitive experiences that CASE@KS1 aims to provide? What are the negative and positive aspects of working in this way and what can the experiences of three children add to the vast array of psychological and educational research on metacognition?

3 METHOD

The observations of the seven focus groups of children (four experimental and three control) were analysed with reference to Flavell's model of metacognition (Flavell, 1979) and the results reported in the previous chapter. From this broad categorical analysis various themes emerged which provoked further questions about how metacognition was being developed and experienced in the group. Of these themes, three areas seemed to be important because they:

a) were the product and producer of high quality verbal interactions
b) they reoccurred on different levels across the experimental groups
c) they were largely absent from the control school groups

In searching the data for good examples of these themes, the focus of analysis began to change and became centred on an individual child who appeared to clarify one of these themes in her/his dialogue within the group. However, as the analysis proceeded it became clear that the way in which a particular theme was displayed through the group interaction was particular to that group and to the individuals within it. Thus the interpretations of the discourse of the three individual children reported in this chapter are specific to those children in those groups. They are chosen because they show individual children struggling with working in a group and with their own individual cognitive and metacognitive processing. Their stories may be similar to those of other children in the programme but they will not be the same.

The method of analysis of these particular classroom observations is based on case study methods. The case study has been described as

> "a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence" (Robson, 1993)p.146

The emphasis is on the idea that the case is studied as valuable in its own right, but also that its value rests on its "usefulness as models for others in exploring their own unique situations" (Elliot, 1990). Whilst Stake suggests that "case study is defined by interest in individual cases, not by methods used" (Stake, 1994), there is a general view that case study should involve multiple data collection methods in order to triangulate and produce a rich and deep description of the particular case. In this study the interpretation of the interactions of one individual child with the group is based solely on transcribed audio recordings of these interactions and field notes taken before, during and after the observation. These studies then are limited in that little is known about the home/social and larger school life of the children. During the year some information on these factors was gathered from teachers and from relating to the individual children. However, this was on an ad hoc and anecdotal level and so was consciously excluded from the following analysis, although of course there is the problem of this slight knowledge unconsciously affecting the selection of data to be analysed. The only way to counter this is to be aware that this may be happening and to bracket out this other knowledge from the analysis as far as it is possible to do so. The three case studies then are not triangulated at this micro level, but in the larger context of the whole study they form part of a multi-method analysis of the different factors which may impact on the development of metacognition in young children.

A further limitation of this part of the study is that whilst it purports to analyse an individual's metacognitive reactions in a group setting, the setting itself is constrained by the structure of CASE@KS1 tasks. Thus the children are in part reacting to this structure as well as to being participants in a research project. Whilst usual classroom norms may be altered by CASE@KS1 tasks eg. putting hands up/not putting hands up to ask questions, general classroom etiquette is still maintained so that expectations of what will happen in a CASE@KS1 group will differ from expectations of what will happen in free social groups eg. at playtime. These factors will all influence the observed performance of the individual within the group. In addition some children will have more problems working collaboratively than will others. The observations at various times show some group dissonance which may be a result of language, cultural or personality factors. Some children disengage from their group for various reasons, some of which we see below. Taken as a whole the observations over the year show naturally occurring inconsistencies, possibly due to the above factors. Thus the descriptions provided here are unique. The aim in analysing these interactions is to show how these individual children, two from one focus group and one from a different focus group experience the awakening and development of their own metacognition through collaboration with their peers on CASE@KS1 tasks.

4 CASE STUDIES

The first two case studies are taken from the same focus group in one of the experimental schools. School B is a voluntary aided primary school with nearly 200 children on roll. The teacher of class one is newly qualified and in her first year of teaching. Class one consists of 30 children all aged five to six at the start of the school year. The children come from a variety of ethnic backgrounds and overall 48% of the school population have English as a second language. This CASE@KS1 focus group consists of six children all of whom have good spoken English and all of who are slightly above average for the class in terms of maths attainment as measured by teacher marked school tests. The group consists of four boys and two girls. The boys are Andre, John, Joseph, Oliver and the girls are Chloe and Fumi.

4.1 CASE STUDY 1

Chloe – "The need to explain"

At the beginning of the year Chloe is five years and five months old. She is articulate and confident. She can be relied upon to give an opinion on most subjects and she appears to be at ease talking with adults and children alike. Her speech patterns include adult-type structures such as "*actually I would say ...* " or "*I wouldn't think that could be true*". Chloe appears to be popular with other children and she often takes the lead in group activities.

In common with the rest of her group, at the beginning of the year Chloe's engagement in the collaborative process of CASE@KS1 tasks is limited. In the first term's tasks the majority of the interactions are between teacher and child or children. The teacher begins trying to facilitate metacognitive thinking by the group by asking "how" questions "how do you know that? "how could we begin this?" and by expecting evaluation "was it easy or difficult to do?" and "why?" In these early CASE tasks there is little obvious metacognition going on from the children's point of view. More often the children including Chloe will directly answer the teacher's questions with short simple answers:

Flowers Task – Start of autumn term

Chloe: *I'm measuring these* [holding two plastic flowers together]

Teacher: *which one have you chosen, how are you going to work out which is the tallest one?*

Chloe: *this one*

Teacher: *how do you know that*

Chloe: *because I measured it and then I can see*

As the term goes on Chloe begins to fill the leadership role, but this does not go uncontested:

Farm Animals Task: Autumn term

John: *that will make a nice pattern* [he has sorted animals into lines by species]

Chloe: *good idea, cos it will go together a bit more than we're doing* [referring to other strategy of sorting animals into adults and babies which some of the group have done]

Chloe: *this is going all wrong, I think they should be lines of same animals, put sheep over there* [Andre is not listening, he wants to put pig in the sheep line because it is the same colour, Chloe moves Andre's pig]

Andre: *I don't know what she's doing*

Chloe: *you're putting baby pigs in order and in order of colour*

Andre: *I didn't understand any of what she said*

Teacher [to Chloe] *Ask Andre what he doesn't understand*

John [explains to Andre how he has put the red pigs in order]

Andre: *what's Fumi going to do* [Andre has noticed that Fumi is not involved]

Chloe: *someone should tell her*

Oliver: [tries to explain to Fumi]

Chloe: *this is a very complicated sort of pattern*

In this excerpt whilst Chloe begins to evaluate the group's ideas and drives the task onwards she fails to respond to Andre's requests for her to explain her actions. Even when the teacher reinforces the request, it is left to another child to explain. Chloe attempts to carry on her own sorting strategies whilst delegating the explanation of the strategy to others. A lack or unwillingness to explain is hindering Chloe's self-goal of completing the task. A similar situation occurs during the next task, which is also concerned with classification. In the buttons task the number of variables by which the buttons could be sorted is increased and the task becomes more complicated as the children must finally use their sorting rule to fill an empty set.

Buttons Task – Autumn Term

Chloe has again taken the lead, but this time instead of asking for explanations Andre has physically removed himself from the group:

Teacher: *why do you think he's over there?*

Chloe: *cos we're not explaining*

Chloe to Andre: *we'll help you, we'll tell you what to do*

Teacher: *do you think Andre wants you to tell him what to do Chloe?*

Chloe: *he doesn't understand what we're doing*

Teacher: *well do you think by telling him he'll understand what do you think you could do instead?*

Oliver: *show him*

Chloe is beginning to show some metacognitive processing. She is becoming consciously aware of what others in the group are thinking. Later during the same task both Andre and Fumi tell Chloe again that they don't understand:

Fumi: *I don't know what she's saying* [looking upset and sniffing], *all she's saying is put it there, I don't understand where to put it*

Chloe: *OK well that's quite easy to explain*

[but Chloe goes off on another idea of how to sort the buttons and doesn't in fact explain the first strategy]

Whilst Chloe is clearly not responding fully to the group's requests for explanations, she is beginning to acknowledge the requests.

Rocks Task – Start of Spring Term

The children are using different criteria to determine "biggest", causing some confusion:

Chloe: *you can't just think, you have to measure them*

Andre: *unless you can see*

Chloe: *yes, that's the tallest*

Joseph: *biggest not tallest*

Andre: *they are saying that this one is bigger than this one, and I say this one is bigger*

Joseph: *what he's saying is bigger is taller*

Chloe: *I think what we should do is talk together*

[the rest of the group carry on measuring rocks]

Chloe: *well I think we should just talk and decide how we are going to do these things*

[Chloe suggests a strategy for measuring "bigness". Oliver and Joseph suggest other equally possible criteria for measuring "bigness". Chloe gives up trying to lead the group her way and puts her head down on the table]

Teacher: *why aren't you joining in any more, have you done all the thinking you can do?*

Chloe: *my brain's hurting*

Chloe has certainly developed some understanding of the need to explain her strategy to the group, but is also becoming aware of the difficulties of getting a consensus in order to move forward from discourse to action. This is a metacognitive experience since it is concerned with understanding that others think differently from oneself, and that there can be more than one useful strategy for solving a problem. It involves metacomprehension in that it requires understanding of how others are understanding the term "bigness". Metacognitive experiences are often emotional and Chloe clearly shows what she is experiencing both verbally and non-verbally.

<u>Shapes Task – Spring Term</u>

During the spring term Chloe is often challenged to explain her thinking to the others. In the shapes task the children are trying to draw and then describe the shapes they can see from their individual perspective around the table. Some of the three dimensional shapes are in front of the others and at times only part of a shape is in view. Joseph has drawn his view of the table showing the circle only by its edge. This has confused Andre and Fumi

Andre: *what is that?*

Joseph: *the circle's not just round its got edges*

Fumi: *what is it?*

Chloe: *its like a flat thing and some edge, curved sides, so if you're this side its actually put so that you can see this side, but if you go like this [leans to one side] you can see this side*

Andre: *what?*

Teacher: *can you have another go Chloe, Andre still doesn't understand*

Chloe: *its part of it because the shapes are in the middle and this shape is on the edge, I think* ... [tails off]

Teacher: *yes*

Chloe: *No, I don't understand what I'm saying myself*

Fumi: *from the other side you can only see this edge so he's drawn the edge of the circle*

Here Chloe has had to reflect on her own understanding of the drawing and her own thinking from her first explanation of it to come to the realisation that she doesn't really understand it herself. Inadequate though Chloe's explanation has been in terms of her own thinking, it has helped Fumi to clarify hers, so that she can now explain the drawing in a very clear and concise way.

There are many instances throughout the spring term where Chloe's attempts to explain to the others are not understood, but she is becoming more aware of her own lack of understanding through this process.

<u>Crossroads Task – Summer Term</u>

Chloe has explained how she came to choose the card that represents her view of the crossroads, but Fumi thinks another card is the correct one:

Chloe: *Fumi look that tree is on different sides and the bus stop is on different sides*

Oliver: *that's on the right*

Chloe: *you see this picture, the car is at the bottom and on this picture ...*

Andre: *she doesn't know which picture, you're just saying and this picture and this picture*

Chloe: *but the bus stop and the duck picture*

Teacher: *but they've both got the duck and bus stop – the picture with the green dot?*

Chloe: *yes the green dot picture has the duck on this side*

Fumi: *I don't understand which picture*

Chloe: *Well, what I'm saying is that is at the top* [pointing to the duck on the board] *and that is at the bottom of the card,* [pointing to the duck on the card] *mmm, I can't really understand it myself*

Andre: *so you don't know what you are talking about*

By the end of the summer term Chloe has come a long way in terms of understanding the need to explain her thoughts and actions and in reflecting on her own understanding. She also begins to use comparisons to explain her thinking as in this task:

Bottles Task – Summer Term

Andre: *this bottle will roll down and this one won't*

Teacher: *how do you know that?*

Andre: *because this one has less rice*

Teacher: *so what does that mean?*

Andre: *so it will go further*

Teacher: *why does having less rice mean it goes further?*

Chloe: *I don't understand this, he's not telling us why. I think Oliver's idea is right, the lightest will go further, the heavy one is slower*

Andre: *yes, yes*

Chloe: *it's like Sara and me when we rolled down the hill, I was lighter and rolled further*

John: *but bottles are smoother than people so it's not the same*

By the end of the summer term explaining her thinking has become a natural response for Chloe and whilst her ideas are not always proved correct her explanations of her thinking are growing in clarity.

In one of the final tasks of the year Chloe clearly states her reasoning and why she disagrees with other group members to do this she refers to a rule of the task

<u>Transport Task – Summer Term:</u>

Chloe: *moving the motorbike would not break the rule, the rule is lorries are not allowed in the middle of town, if you move the bike that would not be breaking the rule.*

For Chloe to develop this clarity of explanation she has had to develop the ability to reflect upon her own understanding and to reflect on how she has come to her own solution.

4.2 CASE STUDY 2

Oliver- Planning, evaluating and predicting

At the beginning of the year Oliver is five years and seven months old. He is also articulate, but a little more reserved than Chloe. He tends to take time to think about things before speaking. At the beginning of the year, like Chloe, he responds mainly to the teacher's questions or instructions and looks to her for a lead. However, he also pays particular attention to the task in hand and suggests strategies for solving problems either verbally or quite often by doing something and then explaining when asked to do so.

In the flowers task it is Oliver who first comes up with the strategy of measuring the roses by comparing them to the block in which they will be placed. When Fumi starts measuring at a different level to the others it is Oliver who realises:

Oliver: *she needs to measure it here, put end on the table*

In the first term it is often Oliver who comes up with a useful strategy and more often than not gains positive feedback for this from the group by them adopting his strategy.

Farmyard Task Autumn Term

In the Farmyard task it is Oliver who suggests not only a strategy for sorting the animals "*put all the blue ones here*" but also how this should be arranged: "*each person has different animals, then put sheep in a line and ducks in a line*" and then goes on to monitor the group as they do this:

Oliver: *Why aren't you doing it like this ? Who's doing pigs ?*

and later

Oliver: *this big duck should be near the little duck, we need to put the purple line together....... these are too squashed they keep falling over*

In the buttons task Chloe refers to Oliver's strategy:

Buttons Task – Autumn Term

Chloe: *He's got a really good idea that I think everyone will agree with*

Oliver is beginning to pick up on and comment on how the group is working for instance later in the buttons task:

Oliver: *we are sorting them out good, but not talking*

Chloe: *yeah so nobody knows what we're doing*

Oliver is monitoring the progress of the group in terms of achieving the goal. A metacognitive process which leads Chloe amongst others to agree that they need to employ the metacognitive strategy of talking about and planning their approach as well as explaining what they are doing. It is also Oliver who suggests that Chloe should "show" Andre how she is sorting the buttons rather than tell him. Of all the group, Oliver seems to be most consistently aware of the feelings of other members. He responds to these feelings in a practical way, by ensuring that the group focus on the problem at hand, often verbalising the group's actions, as we see later in the Buttons task:

Oliver: *Andre what we are trying to do* ......[he is interrupted by Chloe who takes over the explanation]

Chloe: *Fumi's putting hers there and we're all putting them here*

Oliver: *Well we're actually trying to put these ones like they're big and then they go small* [pointing to a row] *but they're aren't any more small* ......[interrupted by Chloe]

Although Oliver is most observant about the group, his interjections are often picked up and continued by other more vocal members especially Chloe, he always gives way.

Oliver continues to suggest strategies in the spring term, in the Rocks task suggesting different strategies for the group to decide upon:

<u>Rocks – Spring term</u>

Oliver: *we should measure them like this* [holding two stones together to compare their height] ... *or we can do it like this* [putting stones side by side]

but when the group seems to be overloaded he also responds:

Chloe: *my brains hurting*

Joseph: *I can't fit more in my brain*

Oliver: *half time*

Teacher: *half time, good idea.*

At the end of the task Oliver suggests that the stones are turned over to see the letters and continues to talk with Joseph about other ways of sorting them after they have been tidied away.

Like Chloe he also begins to use increasingly sophisticated ways of explaining his ideas.

<u>Shapes Task – Spring Term</u>

Oliver: *these are actually to do straight, you can't turn your head, cos your other angles wrong and you have to cross it out again, like here, if I was over here* [he moves around the table] *I could see it*

Teacher: *why can't you see the little triangle*

Oliver: *Cos this triangle is in the way, it's just like when you go to school, the big children go behind the little children so that they can see. I think Chloe can see them.*

Oliver is using his knowledge and experience to help his problem solving in this task. He is also growing in awareness of different perspectives and this allows him to suggest a useful plan to the group of how to tackle the crossroads task:

Oliver: *If we are looking down we can see everything, pretend you are a bird in heaven looking down.*

Clown Task – Summer Term

In this activity Oliver helps the group to plan how they will approach the task:

Oliver: *I think we should pick the same colour and do different clothings, cos then we will be able to pick all the colours really easily*

The group evaluate Oliver's idea along with other plans:

Chloe: *I think we should do the same colours because then it wouldn't be as tricky as it was before*

John: *it would be really really easy, we'd be done in a minute*

Andre: *I know some could take same colours and some different colours then it would work*

Oliver: *why can't we do like I get all the green colours and John would have to have that and Fumi she'll have all the purple*

T: Ah but what was the task ?

John: *We need to have not the same colours*

Oliver: *we could all pick like one different clothing but all green, then maybe all purple, then maybe all pink*

Joseph: *that's a good idea, last time we were taking them out and it got really tricky at the end because we had to keep swapping over*

Oliver's plan is finally adopted by the group, but confusion arises as to how it is to work, again Oliver organises the group:

Chloe: *Yes, but you see I've already had my turn, so it's the second round*

Joseph: *No but I don't know if we're going Andre, Chloe, me Oliver or not*

Oliver: *The first round we're not, I think we should go Chloe, Joseph ....just pick a colour and then we'll put everything that colour on our clowns.*

Despite Oliver's best efforts some confusion arises and at the end the teacher asks them to evaluate

Teacher: *do you think this was easier this time or last time*

Oliver: *this time*

Chloe: *because we didn't have too much muddling, last time we had 700% muddling*

Teacher: *what do you think Oliver, do you think your strategy works?*

Oliver: *yeah*

Teacher: *how do you know it works?*

Oliver: *because we did it in the end*

Andre: *for once we got it together without muddling up*

Oliver: *I think if we do this again I've got another strategy, next time we should write down the colours*

Oliver has gained confidence through having his plans and ideas evaluated by the group and he is able to fine-tune his strategy ready for next time. In order to use this refined strategy Oliver will need to use metacognitive processing to compare the structure of a new task with this one in order to evaluate whether the strategy will be successful in another context. There is a slight hint of this transfer in the bottles task when the group, having predicted which bottles will roll, are finding it difficult to decide where to put the bottles that they feel are neither light nor heavy:

John: *everyone is doing it but I don't know where to put them*

Fumi: *here's the losers and rollers over there*

Chloe: *these are heavy so these are winners*

John: *where do we put mediums*

Oliver: *put them in both groups*

This remark by Oliver is a possible transfer from the dinosaur sorting task when an overlapping set is formed to include dinosaurs that have criteria common to both sets. However, in this case the strategy will not work and the group rejects the idea and decides to put the medium bottles with the losers.

Of all the children in the group, Oliver has throughout the year, come up with strategies, not only to solve the cognitive problem at hand, but also to organise the group. He is consistently aware of what the individual members of the group are doing and how the group itself is functioning. Whilst not all his attempts to do this are successful and he often gives way to other ideas in the group, when others fail to explain or begin to take the group in an unproductive direction Oliver intervenes.

Through the year as his confidence in speaking in the group grows, his ability to plan, predict and evaluate cognitive strategies becomes more apparent and his growing metacognitive processing acts as a control and monitoring tool for group. Over the year, a dynamic is played out between Oliver's own need to employ metacognitive processing to enhance his own problem solving skills, which is enabled by the group collaboration, and the needs of the group itself for a group metacognition, to enable it to function successfully to solve the CASE@KS1 tasks.

Oliver was particularly sensitive to the feelings of other members of the group and emotion plays a part in metacognitive development, as research on feeling of knowing judgements (Lories, Dardenne, & Yzerbyt, 1998), and theory of mind (Wellman, 1990) suggest.

The above two case studies have shown individual children working in the same group. The following case study highlights a different aspect of metacognitive processing. It is most clearly shown through the group dynamics of a CASE@KS1 group in school A, where the teacher whilst equally proficient and with only a little more experience than the school B teacher, has a very different style.

School A

This school is a state funded secular or county school. It has a one form co-educational entry with a total of 196 pupils. Pupils are grouped in seven classes from reception to Year 6. 84% of pupils come from minority ethnic backgrounds and nearly 50% from homes where English is not the first language. 31 languages are spoken in the school, and there is a fluctuating population of refugee and asylum seekers, many of whom are housed in short stay accommodation. Nearly a quarter of the school roll transfers each year. This high level of fluctuation affected the CASE@KS1 focus group. The group began with six members, but one left in the Autumn term before the project really got underway and so was not included in any analysis and another left at the beginning of the Spring term, thus only four children from this focus group finished the year. The class consists of thirty children, eleven of whom joined in January, having been moved up from the Reception class at the beginning of the term in which they have their fifth birthday. So at the start of the year there were only nineteen children in the class. The teacher was newly qualified and beginning her probationary year. The group consisted of three girls: Kali, Sarah and Gillian (Gillian left in January), and two boys Ryan and Charles. The group was deemed to be average for the class in terms of teacher assessed maths scores and all had good spoken English.

4.3 CASE STUDY 3

Sarah – "knowledge of self and others"

At the beginning of the year Sarah was five years and nine months old. She is a particularly friendly child and likes to chat along about stories and out of school activities. She particularly likes reading and has a reading age in advance of her chronological age. She always appears to be smiling and laughing but she can get upset very easily. She is confident speaking in a group and talking to adults. At the start of the programme Sarah is concerned to make known what she knows, but finds that she doesn't always get the openings within the group to do this:

Flowers – Autumn Term

Teacher: *Can anyone remember what we did last week?*

Charles: *we had wood*

Teacher: *we had wood, didn't we, can anyone remember what we did with it?*

Sarah: *I do*

Charles: *we made, made a staircase*

Teacher: *we made a staircase, we're going to do something a bit like that today*

Sarah: *I know*

Teacher: *How do you know Sarah?*

Sarah: *Cos when other people came I saw them*

The teacher's approach is very gently, repeating what the children say rather than pushing them along. She picks up Sarah's statement of knowledge and challenges it with a question aimed at making Sarah reflect on her knowledge.

However, the teacher's gentle style combined with the predominately teacher/child rather than child/child interaction during this first term leads to a discrepancy in the intentions of the teacher and the intentions of Sarah as this excerpt from the Flowers task shows:

Teacher: *Oh that's a good idea Kali, does anyone think they are the same size*

Sarah: *No*

Teacher: *Have a look, I know it's quite difficult. Is there one bigger or one smaller?*

Gillian: *that one's bigger and that one's nearly*

Teacher: *nearly the same size isn't it, but it's a bit*

Sarah: *that's smaller and that's bigger than that*

Teacher: *so do you think this one is the biggest in the whole pile?*

Sarah: *and if you get one more* [picking up another flower]

Teacher: *do you think so*

Sarah: *it will be the middle and then just one more* [picking up another flower]

Teacher: *which ones are you looking for to try, which ones are you looking for Sarah*

Sarah: *this ones more bigger this one's smaller*

Teacher: *OK shall we try* [Sarah is putting flowers in the rack], *hang on a minute Sarah we haven't decided something have we?*

Throughout this task Sarah tries to race ahead of the group and the teacher to complete the task herself by trial and error. Whilst the teacher aims to keep her own discourse going regarding planning the activity and deciding how to measure the flowers, Sarah aims to shape the discourse her own way and to move on to action without regard for the rest of the group. When thwarted she begins to work as part of a pair with Gillian, but only so that she can put in as many flowers as possible, whilst the teacher resorts to making the group take turns at putting the flowers in. Towards the end of the task Sarah is keen to make her statement:

Sarah: *I did all of them*
Sarah to Kali: *I put this one in and this one*

Sarah's motivation here seems to be to finish the task herself quickly and without help. The teacher, on the other hand, tries to provoke a more metacognitive approach by slowing the group down and getting them to reflect on how they are solving the problem. The discrepancy between the teacher's intention and Sarah's intention is an important one and reoccurs as a theme throughout the year.
In the dinosaur sorting task it is Sarah who eventually discovers the problem. She is very excited about this:

Dinosaurs – Autumn Term

Sarah: *hey I know that's a t-rex but it's yellow it should be in here* [meaning hoop containing yellow dinosaurs]

The rest of the group however, feel that the t-rex should remain with the other t-rex. Sarah is now alone in her idea:

Sarah: *that was yellow, that should be here* [in hoop with other yellow dinosaurs], *doesn't matter if it's the same as that*

The group maintains the opposite point of view and Sarah begins to get upset and angry. The teacher refers to the emotional effect of the group decision on Sarah rather than the logical consequences of their decision for solving the problem:

Teacher: *Oh dear we've got some unhappiness here, Sarah is unhappy .... Sarah says it's yellow and should be in this hoop* [with other yellow dinosaurs], *what do you say Kali ?*

Kali: *it should stay in there* [hoop with other t-rex]

Teacher: *but then Sarah's going to be unhappy if we leave it there, has anyone got an idea of how we could solve this problem?*

Gillian: *put it there* [in the hoop with yellow dinosaurs]

Teacher: *but then Kali's going to be unhappy because she wants it in the t-rex hoop*

Eventually Kali has an idea:

Kali: *put it in the middle so that it's here and there* [she places t-rex standing with legs on both hoops]

Teacher: *well what a great solution*

Sarah: *That's what I was about to say, I was about to say put it between them*

The nature of the problem has been changed here from a logical classification problem to a problem of how to make sure no one is unhappy. The result though is that Sarah has to defend her self image by not allowing Kali to "win" by finding the compromise solution. Sarah's statement here may be consciously untrue, unconsciously untrue ie. a false metacognition in that she genuinely thinks that she was about to give the answer, or a conscious true metacognition. The emotional context of it though makes it even more difficult to interpret this statement.
This emotional context to the group is maintained and encouraged by the teacher through the rest of the task:

Teacher: *could you explain to everyone why we should put the t-rex there* [in the middle]

Charles: *if we put there* [hoop containing other t-rex], *Sarah will be crying*

Gillian: *or we could share it because it's not fair*

Sarah: *if I put it in here* [hoop containing yellow dinosaurs] *then she'll be unhappy*

Teacher: *so why did you decide to put it here* [in the middle] *Kali, can you explain to everybody*

Sarah: *I had that idea too*

Kali: *cos when we put it here yeah*

Sarah: *then we'll be sharing*

Kali: *then it will be kind*

For Sarah the important aspect is that her voice is heard, that the group acknowledges that she also had the solution to the problem. Having just undergone the experience of being outside the group, Sarah is now acting to protect her self view. Her view of her self is in this case tied up with her metacognitive knowledge of her self as a problem solver. Defence of this self-efficacy leads her to possible false metacognitions and stops her from working collaboratively to the extent that when another group member is allowed a turn she gets more upset.

<u>Later in the dinosaur sorting task</u>

Charles: *it's an elephant so it goes in there* [he puts the mammoth in the middle of two hoops]

Teacher: *Ah*

Sarah: *I was just about to say again* [she is starting to cry]

The emotional context of this group remains high throughout the year. The teacher often refers to social skills such as kindness, sharing, helping, being upset, being friends and the children also use this language when asked to describe what they are doing. Throughout the year, Sarah is the most overtly emotional of the group but this emotional level is facilitated by the group interactions, eg:

<u>Clowns – Spring Term</u>

Sarah: *the triangle, square and circle I keep getting them muddled up*

Ryan: *Sarah when you say trousers, say trousers not trouser*

Sarah: *I didn't say trouser. Everyone is copying me.*

Sarah to Kali: *the rules are you can't have the same colours*

Teacher: *well done for pointing that out Sarah, because you are helping your friends*

but later Sarah has to admit

Sarah: *I don't know how to do it*

the teacher suggest the group help Sarah

Sarah: *I know what the rules are, the rules are you're not allowed to put on the same colours and the same patterns* [she appears very confused and her voice is upset]

In this extract Sarah is being more metacognitive, becoming conscious of her own cognitive processing "*I keep getting them muddled up*", "*I don't know how to do it*", "*I know what the rules are ..*" but these beginnings of metacognition are steeped in emotion. Sarah's feelings of confusion consciously recognised in this metacognitive way are at odds with her belief about her self as someone who *"knows the answer"*, *"has an idea"*. The discrepancy between her stored self-image and the feedback from her ongoing metacognitive processing is leading to confusion and unsettling emotions.

As Sarah moves through the year she begins to develop some metacognitive knowledge about her self which conflicts with her self image from the beginning of the year. The structure of the CASE@KS1 tasks with their inbuilt cognitive conflict and the context of collaborative problem solving force this uncomfortable development upon her. In the group situation Sarah's early stance of knowing what to do is challenged by other children having alternative ideas, which also prove correct.

5 DISCUSSION

These three case studies highlight different aspects of the development of metacognition, but of course the aspects overlap. Common to all three case studies is the importance of the interaction between task, context and individual. In the case of Chloe and Oliver the logical progression of the group towards a consensus solution is encouraged by the teacher and this facilitates the practice and development of metacognitive processing linked to logical problem solving: planning, predicting, explaining, evaluating. In the case of Sarah a different aspect of metacognition is to the forefront. The emotional/affective aspects of this focus group are encouraged by the teacher and through this Sarah begins to develop beliefs about herself based upon her performance within the group.

The collaborative group is an essential element of this growing awareness. It is within the group situation that Chloe is made to be explicit about her ideas. She learns that she needs to reflect upon those ideas and have them clear in her own mind. She also learns that other people's comments and reactions to her ideas can enable her to clarify or modify them. Realising that she doesn't always understand what she has said is an important aspect of monitoring and controlling her thinking. Asking questions of oneself can begin by being questioned by others.

Through the collaborative nature of the group these children are not only learning the social group skills of listening, contributing and sharing, the group is also impacting upon their individual ways of thinking. In the early part of the year the teacher was still the driving force of the group, but as the year goes on she is able to take more of a back seat, sometimes gently steering the group rather than driving it. It is this skillful facilitation of the group that encourages the children to become more aware of their thinking. The teacher becomes a model for the language and behaviour associated with higher level thinking. Both Chloe and Oliver learn something about themselves as cognitive beings. Chloe admits to herself that she doesn't always understand, Oliver realises he has some good strategies for solving the problems. Feedback from the group is encouraging this development.

It is particular to the CASE@KS1 programme that the focus groups constituted at the beginning of the year remain together working together on CASE@KS1 tasks each week for the whole year. As Nelson has observed

> "social encounters are replete with metacognitive determinations about the cognitive and motivational states of other people" (Nelson et al., 1998)p.143

We can see in the case study examples above that the children's metacognitive development is progressing in terms of these social areas as well as in logical problem solving. This means that any observations of children working together must take into account within group social factors, individual personality factors and external group factors such as the teacher's style and motivations and the usual classroom environment.

Social psychologists have pointed out that people are sensitive to and change their behaviour, including their cognitive behaviour, in relation to perceived changes in their social and physical environment, (Fiske & Taylor, 1991; Higgins & Kruglanski, 1996). The nature of these adaptations though is also dependent on conceptions of the self. Research from social psychology has shown that people have beliefs about their own "self-efficacy" (Bandura, 1995), about their abilities, (Ellis & Kruglanski, 1992) and also estimate their own intellectual abilities with reference to their own beliefs about their social group, (Levy & Langer, 1994). People who are low in self-efficacy are found to be easily discouraged and tend not to apply the metacognitive dimensions of self-regulation. Bandura has suggested that beliefs about self-efficacy develop from either modeling of others or the direct influence of others, as well as from past experiences, (Bandura, 1995). These beliefs about the self affect the acquisition of metacognitive strategies and these acquisitions may in turn affect the beliefs about the self, (Jost et al., 1998).

The metacognitive development of the children working in CASE@KS1 focus groups, is being facilitated by the teacher modeling metacognitive strategies, by the members of the group directly challenging, persuading and agreeing with each other and by assimilating a number of metacognitive experiences over the whole year.

It is particularly important that the group is led in such a way that positive metacognitions are modeled and that negative or low self-efficacy beliefs are challenged. In particular, other classroom and experimental studies have shown that the beliefs children hold about intelligence are strongly associated with learning and performance, (Ferrari, 1996).

Some children have been found to subscribe to a fixed theory of intelligence, which shows people possessing or not possessing an aptitude for a particular subject. If children holding these beliefs do badly on a test they tend to have feelings of self-deprecation and helplessness. Other children may hold a theory of intelligence, in which people can increase their aptitude in a particular area. Children holding these beliefs tend to achieve better results and also suffer less when they do less well on a test, (Dweck et al., 1993). These theories about intelligence are part of the store of metacognitive knowledge that we develop over the years.

Metacognitive development, like cognitive development, progresses within the constraints and opportunities of the social and intellectual context. The metacognitive experiences that children are involved with can have far reaching consequences for their self-image and views of their abilities in different areas. Additionally, metacognitive beliefs about others, relying, as they do on external observations of others, have to be interpreted by and in relation to the self. So for Sarah in these case studies, the high emotional content of the metacognitive experiences she encounters through the focus group will affect both her view of her self and of others in the group. There is a danger that untrue metacognitions can go unchallenged and that in Sarah's case, failure to always solve the problem at hand may lead to more general feelings of distress.

Since metacognitive beliefs can be influenced and changed by social persuasion, the way the group is managed and the models of metacognition that are allowed to pervade are all important. In the case of CASE@KS1 the class teacher, her knowledge and understanding of metacognitive processing, along with her own metacognitive assumptions and her intentions towards facilitating metacognitive development in the children are particularly important aspects and these will be considered in the following chapter.

Chapter 9

TEACHERS AND METACOGNITION

1 INTRODUCTION

Chapter 7 showed how different teachers across all the schools, both experimental and control differ in the extent and manner in which they try to facilitate metacognition in their students. The frequency counts of teacher F M behaviours showed that, whilst there is no significant difference between experimental and control school teachers in terms of overall quantity of behaviours, there is a difference in the spread of behaviours employed. The control school teachers used a much narrower range of F M behaviours than did the experimental school teachers.

Chapter 8 showed how the teachers in two experimental schools tried to facilitate metacognition. In school B the teacher was seen to model the language and behaviour associated with higher level thinking. Chapter 8 suggested that the way collaborative groups are led affect the type of metacognition that is produced. In a Year One classroom the teacher is in a powerful position to affect the production of metacognition and challenge negative or low self-efficacy beliefs.

From analysis of sixty nine classroom observations taken over one academic year, it seems clear that all eight teachers were trying to foster good thinking skills in their students. However, some teachers were clearly more successful in terms of the range and complexity of reasoning and metacognition that their students produced.

This chapter aims to investigate what aspects of teacher intervention are important in facilitating the development of metacognition in five to six year old children. Specifically, through analysis of teacher interviews conducted at the start and end of the intervention year, answers to the following questions are sought:

Research Question 4:

What factors associated with teachers impact on the development of metacognition in year one classrooms ?

This lead research question was further broken down in to three sub questions:

1. Does teachers' knowledge of and beliefs about metacognition impact on the development of metacognition in the classroom?
2. Do teachers' beliefs and opinions about learning and teaching affect the way they try to facilitate metacognition in the classroom?
3. Can teachers' ability to promote metacognition be developed through continuing professional development?

2 INTERVIEWING TEACHERS

R.D. Laing suggested that in any room where there are two people there are actually at least six. The two of them and four ghosts "What I think of you", "What you think of me", What I think you think of me" and "What you think I think of you" (Laing, Phillipson, & Lee, 1966).

In order to ascertain someone's opinion we ask a question. It is thought necessary for the interviewer to keep a professional distance in order to receive rather than influence the responses. Successful interviewing though also involves building a rapport between interviewer and interviewee. Achieving this balance is not easy, as Denzin, (1970), amongst many others, points out. But it is thought that this "professional" skill of becoming a "good interviewer" develops with practice and experience. We must guard against asking leading questions or prompting answers by use of verbal or non-verbal communication. The interviewer is supposed to be aware of their own influence, both verbal and non-verbal on the interviewee. The interviewer must take into account both physical and emotional contextual factors, must achieve some kind of rapport or friendliness whilst remaining objective, being friendly but not too friendly, must keep the interviewee focussed on the questions, but not lead them to answers. The interviewer must also allow the interviewee to express their opinions fully whilst adhering to time constraints and perhaps, above all, the interviewer must actively listen to the interviewee's responses, whilst maintaining eye contact. It is obviously not professional for an interviewer to show nervousness, boredom, apathy or to lose track of the interview, to mentally switch off, or to maintain eye contact to the extent that her eyes glaze over. Yet all of these "negative" aspects of the interview process occurred during the fifteen interviews carried out for this project. Rather than invalidating the data collected, these natural human failings render the interviews authentic.

These conversational encounters with the teachers involved far more than the transcribed data of the questions and answers. Through these encounters I came to understand something about each of the teachers involved and I came to understand something about what I thought they thought of me and what I thought they thought I thought of them. Hearing their voices again sometimes months later when transcribing the interviews, involved revisiting these initial encounters.

The act of transcribing whilst undertaken as "verbatim" transcripts actually involved reviewing the interviews. It is at these points – the initial meeting, the transcribing and the following readings of the transcripts that the analysis of the data is constructed. Investigating how feelings and states of mind of the interviewer affect this analysis would involve a psychoanalytic approach to the research, which is outside the scope of this thesis. However, it is acknowledged that the following analysis has been informed by both conscious and unconscious interpretations.

3 PRACTICALITIES

The interview questions for the set of interviews to be carried out at the beginning of the intervention year (September 1999), were devised to gain information about teachers' perceptions of their "style" of teaching and their beliefs about how children learn and should be taught in year one. The questions also asked about the teachers' knowledge of metacognition as a theory. After being given a short description of the definition of metacognition used in this project, they were asked if this resonated with them, as being important for children's learning at this age. The teachers were also asked to reflect on their own experience of learning and relate this to the idea of metacognition. The interview schedule was piloted on two other primary school teachers and as the feedback from them was positive, the interview schedule was used for the main study.

Seven interviews were carried out at the end of September 1999. I had met all the teachers once before during the main CASE@KS1 programme pre-testing of the children. In each case the interviews were carried out at the end of the school day either in the teacher's own classroom or in a corner of a usually empty staffroom. Field notes made at the time reveal that these initial interviews ranged from the "awkward", (School B) to the "easy and friendly", (School A). All the teachers were asked all the questions, but in-between they were allowed to veer away from the specific question. Some teachers took the opportunity of being listened to, to give their unbidden views on education policy or staffing resources or curriculum matters. In general though, in these first interviews, the teachers tended to keep to the point of the questions and consequently, the interviews did not last longer than 45 minutes.

In March 2000 the original school C teacher left her school and was replaced by a new very experienced teacher, who was initially employed only for one term. The initial teacher (hereafter labelled C1), was unavailable for interview at the end of the year. The new school C teacher (hereafter labelled C2) was interviewed a week after she started in the school.

At the end of the school year the remaining seven teachers were interviewed again. The interview schedules this time, used answers from the first interviews and asked the teachers if there had been any change since the first interview. For instance School Y interview question 1 end of the year 2000:

L.3 R: One thing you emphasised quite a bit last September was routines and behaviour, do you still feel that these things have the same priority?

*L.6	T: Yes, because I find this class very different from any other experience I've had with a year one class ...*

In this way, the second interviews were more personalised. However, they all covered the same three major areas of: teachers' perceptions of their teaching style, their opinions regarding how year one children learn and how they should be taught and their beliefs, opinions and knowledge of metacognition. They were also asked for actual examples of children in their class, displaying metacognitive behaviour, (See appendix 9.1).

These second interviews were much longer than the initial interviews, on average taking just over an hour each. Due to constraints of the main project, all three control school teachers had to be interviewed on the same day when the teachers were attending a CASE@KS1 professional development day ready for the following year, when they would run the programme. The control school teachers were also interviewed by other researchers on the same day. This was less than an ideal situation and it is probable that "interview fatigue" on both sides has become another complicating factor in these data.

4 ANALYSIS

The analysis of the eight interviews focussed on the transcribed data. The analysis initially concentrated on the teachers' responses to four main questions: firstly, questions about their teaching style, secondly their beliefs and opinions about how children of this age learn and should be taught, thirdly their knowledge of and opinion about the theory of metacognition as explained by me and fourthly a reflection on their own metacognitive capacity. From this content analysis, three major themes emerged. The teachers were placed in one or other of these thematic categories depending on the extent to which their answers concentrated on these themes. Whilst the labels "protective", "child centred" or "disciplined" are just that – labels, they each head up a category which contains consistent beliefs and opinions. The teachers are placed in these categories because their responses to the interview questions are consistently, thematically linked and constitute this particular category.

This analysis is compared to the analysis of the classroom observations, with data from chapter 7 reformulated, to provide comparisons between what teachers say about metacognition and what they do about it in the classroom. A thematic analysis rather than a case study method was used because answers to the initial questions by the teachers, were remarkably consistent and these responses naturally fell into three themes as described below. A case study method was also rejected because the focus of the research question for this project, is factors influencing the development of metacognition in young children, rather than a focus on individual teacher's development. In this sense the importance of the teacher interviews is to gain an understanding of the teachers' beliefs and opinions and knowledge in order to see if this affects the way or the extent to which they are able or willing to facilitate the metacognitive development of their students.

The experimental school teachers all undertook the CASE@KS1 professional development programme, which involved six off-site professional development days, where the concepts and theoretical framework of CASE@KS1 were introduced and the tasks were demonstrated. Of these six days, one hour-and-a-half session concentrated on metacognition. However, all aspects of the programme were open for discussion by the teachers at any of these days. The teachers were also supported in school with six visits by one of the research team and again teachers were able to discuss theory, as well as having the tasks demonstrated. The teachers also visited each other, with four visits, scheduled over the year. There were also a couple of social/conference events to which the teachers were invited.

5 CONTEXTUAL FACTORS

Of all the eight teachers interviewed across the year, three teachers in experimental schools A and B and control school Z were newly qualified and in their first teaching post. The teacher of control school Y was in her second year as a qualified teacher. Teacher C1 was in her fourth year and teacher D was in her 6th year. The remaining two teachers, one in control school X and the other teacher C2, who took over the year one class in experimental school C at Easter 2000, had much more teaching experience, but had both taken long gaps between teaching posts. Teacher C2 had trained as a teacher at the end of the 1960s, whilst the teacher of school X completed her training at the end of the 1980s. They both had diverse experience of different classes, year groups and schools.

One of the major factors affecting all the teachers, but seemingly impacting more on the more experienced teachers, was their perception of the effects of the introduction of the National Curriculum, followed by the Numeracy and Literacy hours and formal testing in terms of end of year 2 external tests. All eight teachers mentioned one or more of these aspects in their first four responses, although they were not directly asked about these issues. The more experienced teachers unsurprisingly, made comparisons between teaching pre- and post- national curriculum. For instance:

Control School Teacher X:

In response to a question about her style of teaching:

> *L7* *"I think I've become more formal as compared to, I was trained ten years ago you see and I took a break and then I came back. It was very much child centred in the training and also lots of group work but because of the National Curriculum, the Numeracy hour and the Literacy hour I've become more formal I feel in my teaching"* ....

She goes on to say

> *L.13* *"in some ways its easier, its more manageable in some ways you know"*

All the teachers mentioned the National Curriculum or external testing, in the first set of interviews. This was generally done in a neutral way, acknowledging the impact and difference these policies have had, but at this stage not voicing any particularly strong positive or negative feelings about them.

6 THEMATIC ANALYSIS

The first four questions of the first set of interviews asked teachers to concentrate on their approach to teaching Year One. They were all asked about whether they thought they had any particular style of teaching, what they thought were the most important aspects of teaching Year One children and what advice they would give to a newly qualified Year One teacher, (Appendix 9.1).

Analysis of these first four questions suggested three main themes. These are labelled "protective", "child centred" and "disciplined". The teachers tended to emphasise one of these themes in response to the interview questions. Whilst there was some overlap in terms of some teachers mentioning more than one theme, the interviews were remarkably consistent over these first four questions, with teachers tending to stick to one theme once they had mentioned it. The following table shows the category allocated to each teacher as a result of their responses to these initial questions.

Table 9.1 Thematic Analysis – Teacher Categories

Category	Teacher	School
Protective	A	Experimental
Protective	C2	Experimental
Protective	X	Control
Child Centred	B	Experimental
Child Centred	Z	Control
Disciplined	C1	Experimental
Disciplined	D	Experimental
Disciplined	Y	Control

Within these categories there is a continuum. For instance teacher D, teacher Y and teacher C1 all emphasise skills, routines and discipline, but teacher D is less rigid about this than either of the other two teachers. Similarly teachers A, C2 and X emphasise social aspects and adopt a protective role, but teacher A is more firmly in this role, with teacher X more in the middle and teacher C2 still emphasising this role, but to a lesser extent.

The child centred category includes two teachers and again there are individual differences within the category. Teacher B's responses are more reflective about her own practice, whilst teacher Z tends to subscribe to a view of teaching which comes from her teacher training course, but which also fits in with her own beliefs. These three thematic categories are further elaborated below.

6.1 "PROTECTIVE"

The teachers in this category emphasised the social aspects of teaching Year One children and the children's emotional development. The key words used by all three teachers in this category in response to the first four questions are: *"patience", "repetition", "reassurance", "encouragement", "praise", "social skills", "listening".* For instance teacher A says that an important aspect of teaching Year One is:

> *L.14 "Not taking for granted that they know what you mean. Being patient about repeating things"*

Control school teacher X emphasises the children's vulnerability:

L.16 *"I think you have to remind yourself that they have been in school only a year or maybe less ....*
L.22 *"they still need lots of reassuring, lots of encouragement"*

and in response to question 4, which asks what advice she would give to a newly qualified Year One teacher, teacher X says of the children:

L.28 *"And also they just need so much more reassurance and encouragement and praise, they are very kind of sensitive and they just fall back if you're not careful and give them confidence so that they can work independently, really that would be the main thing."*

Teacher C2 emphasised the development of social skills:

L. 31 *"I think the social skills are terribly important ..... they've got to learn to listen first of all"*

L.39 *"I also believe in doing a certain amount of free play ...... with painting developing that side of things. A skill that not necessarily has a finished product, but something they can enjoy"*

Development of the social skills of appropriately communicating with other people is an important aspect of early years teaching and rightly acknowledged as important by all the teachers. These three teachers' emphasis on the social skills also includes an emphasis on the children's vulnerability and their role as protectors of children's emotional development and providers of stability. In the classroom these teachers tended to take on a role, which included protection of the individual child to a greater degree, than did the other teachers in this sample. For example, these teachers tended to draw attention to the children's feelings with questions such as *"why is Sarah looking sad?" (Teacher A)* or with references to personal qualities of individual children such as *"you are kind" (Teacher C2)* or reminders to be *"thoughtful", "generous" (Teacher X).* These teachers were also observed to manifest this protective role in other non verbal ways. Most obviously, this involved putting their arm around a child, or asking a tearful child to sit next to them, rather than asking the naughty child to sit next to them, which seems to say "teacher as disciplinarian".

6.2 "CHILD CENTRED"

This theme is about emphasising teaching in terms of the child's individual learning. It involves a view of teaching as trying to expand the child's world and knowledge and to facilitate their natural curiosity. It involves a holistic approach to teaching. This is one that engages the children in intellectual, sensory and experiential ways of learning. It also includes taking account of the child's individual life experiences. The two teachers (experimental school teacher B and control school teacher Z) who encapsulated this approach were both newly qualified and in their first teaching positions. They both placed emphasis on children learning through interaction and through connecting school learning with life. They gave very similar responses when asked about their style of teaching and important aspects of teaching Year One.

Teacher B

> *L. 30* *"really encouraging the children to talk about their experiences to be able to really engage and interact in what they're doing with their life around them..."*

> *L.33* *"if they're* [activities] *all related to things that are related to their life somehow..."*

L.36 "really just to really get involved in it."

Teacher Z

L.4 "very much based on the children, very much based around them what I think they'd be interested in learning..."

L.6 "what they already know, what they bring to the classroom from their background, what they're own personal fascinations are, I think children always learn much more if they can relate to it themselves..."

L.43 "Also I think I've been trying to impress on them that the learning is for their sake..."

L.53 "I'll always encourage the children to build on what they know..."

6.3 "DISCIPLINED"

This theme emphasises behaviour and routine. Answers to the first four interview questions carried out at the start of the year are categorised as "disciplined" if the teacher consistently emphasised the need for good behaviour from the children, before teaching can take place. The three teachers who at the start of the year illustrated this theme placed a great deal of importance on this aspect of their teaching. They also referred to external contextual factors of their teaching, such as the National Curriculum, the Numeracy and Literacy hour, which could be seen to have imposed a disciplined routine on them and which may be affecting their approach to teaching. There is also an emphasis on skills within this theme.

One of the three teachers who stressed the discipline aspect of teaching did have severe discipline problems in the classroom and left the school all together at Easter (experimental school teacher C1). Another had what she described as a very low ability class and at the start of the year, had little classroom support for her high number of special needs children, (control school teacher Y). These larger contextual factors can be heard in the responses of these two teachers.

Teacher Y

L.8 *"The literacy hour and the numeracy hour have already dictated how I teach."*

L.12 *"set them up with skills that will help them to focus at school, discipline and set routines and things that should be followed..."*

when asked about advice to a newly qualified teacher of Year One she said:

L.17 *"Routine and behaviour and not to be so concerned about all aspects of teaching, but be concerned about specific areas..."*

This teacher also remarked on other contextual factors, which impact on her teaching. In particular the fact that children came from different nurseries and reception classes, all with different first experiences of school. Whilst the schools used the same base-line tests, this teacher saw problems with consistency of the tests' administration and this led to very mixed ability classes.

The second teacher to emphasise discipline referred to her own school experience:

Teacher C1

L.4 *"I started off wanting to be very formal which is a reflection of my own education."*

L.10 *"...they work with a task book...I found that a good way of doing things..."*

L.14 *"Its very much now trying to keep them in their seats..."*

L.18 *"There's less play involved and they are already unfortunately being pushed towards doing an exam, a test at the end of 2nd year..."*

L.23 *"I want them to achieve as high as they can in their writing..."*

Speaking of asking open questions she remarked:

L51 *"I find it quite difficult sometimes to do that, its obviously easier to just tell them something..."*

The third teacher to illustrate the "discipline" theme emphasised organisation and skills.

Teacher D

L.20 *"...the reading is a crucial thing to get that off and away..."*

L.27 *"Well the curriculum's set up anyway, what you have to teach that's by the by, the most important thing I've found this year is planning, careful planning and organisation..."*

L.89 *"...for a long time the national curriculum has put the emphasis on teacher to child teaching..."*

L.91 *"I know my self as a teacher coming out of college* [in 1984] *it was very much what you have to teach them not what they need to know."*

7 SECOND INTERVIEWS JUNE/JULY 2000

In the second set of interviews carried out at the end of the year the teachers were asked if their teaching style and approach to teaching had changed since September, (See appendix 9.1).

7.1 SECOND INTERVIEWS "PROTECTIVE" GROUP

The three teachers who were characterised as "protective" in September, (experimental school teachers A and C2 and control school teacher X) all indicated some movement away from this "protective" stance throughout the year.

This change is most marked in experimental school teacher A. At the beginning of the year, teacher A seemed to focus very much on the emotional and social development of individual children. By the end of the year, although she mentions *"social aspects"*, these are couched in terms of working collaboratively.

Teacher A

> *L.6* *"...next year I will focus a lot more on the social aspects of the group, group dynamics... that is something that needs to be supported a lot more in the rest of the class and not just in that group at that time..."*
>
> *L.10* *"I think that without those children working together and being able to accept things from each other everything else falls down."*

She felt that her own teaching style has changed and developed over the year:

> *L.22* *"I listen a lot more and I kind of step back a bit more than I did at the beginning..."*
>
> *L.26* *"And if they go round in circles a bit and go round a bit longer that's fine, I'm not so, whereas before it would be worrying me and now I'm not so concerned."*

Experimental school teacher C2 who joined the project half way through the year had also moved away from her "protective" stance to find the routines and discipline imposed by the national curriculum and literacy and numeracy hours have impacted upon her approach to teaching.

Teacher C2

> *L.12* *"To a certain extent I've had to change it because I'm trying to fit in the national curriculum, which I haven't done before... I'm following rather than separating things now, I'm just trying to follow the guideline of the literacy and numeracy hour really."*

However, there is an element of misgiving in her responses, towards this change, for instance:

> *L.98* *"I do think that there is a general acceptance that the children are fed all this information at an alarmingly fast rate. There isn't any time for further investigation on a particular subject because you are following a week to week routine."*

In answer to a question about her opinion of the CASE@KS1 professional development programme she begins to reflect on why some children may be more metacognitive than others and concludes that television viewing habits are largely to blame. She then recounts an episode of over hearing these young children discussing an adult audience participation programme and she expressed her horror at realising that viewing this type of programme was fairly common amongst her year one class. Whilst this opinion has no particular connection to the development or facilitation of metacognition from a theoretical point of view, this teacher felt that this kind of television viewing had a negative impact on the children's developing cognition. She did not provide any evidence for this, other than her own belief.

The third teacher in this group from control school X continued to emphasise the need for confidence boosting praise whilst acknowledging a change in the children's growing maturity and their need for more independence.

Teacher X

L.10 *"...they have to take responsibility for their learning..."*

L.11 *"...also as they get to the end of the year I would expect more independence from them, but that doesn't reduce the encouragement and the praise and the confidence building."*

L.43 *"I encourage the primary helpers or whoever is in the classroom to be positive rather than negative."*

Asked for advice for a newly qualified teacher of Year One she responds:

L.151 *"Confidence building really and try to be as positive as you can."*

L.155 *"Keep the child happy really and then she will be able to learn."*

There appears to be a qualitative difference between the changes to their teaching that these three teachers report at the end of the year. All three acknowledge the growing maturity of the children over this year, which spans the chronological age of five to six years plus. They refer to this developmental change in reference to a change in their own approach to teaching. However, there are notable differences.

The control school teacher, X, recognises this developmental process, but still emphasises her own role in terms of building confidence and giving encouragement.

The experimental school teacher, C2, shows her ongoing concern for the children's emotional development particularly through her examples of the television viewing habits of the children in her class. She is concerned too with the rate at which children are expected to achieve and indicates that external factors such as the national curriculum have speeded up this process, allowing less time for practice of newly learnt skills.

The experimental school teacher A more clearly indicated how she feels she has changed through the year. She said that her newly developed emphasis on group working skills would be implemented in the following year. She has moved away from her initial focus on the emotional development of individual children, to a concern for facilitating good collaborative working skills. Whilst this may still involve taking account of the individual's social skills, there is less emphasis on "emotional development" and more on the interactions between members of the group.

7.2 SECOND INTERVIEWS – "CHILD CENTRED" GROUP

The two teachers (control school Z and experimental school B) categorised under this heading at the start of the year referred to teaching children as *"engaging them"* and used words such as *"interact"*, *"involve"*, *"life experiences"*, *"fun"*, *"practical"*, *"working out"*, *"problem solving"*. Whilst both teachers began the year with this view of teaching, at the end of the year teacher B continued to stress these aspects of teaching, but acknowledged that the children have matured and that she doesn't have to concentrate so much energy on behaviour. She referred directly to learning how to learn.

Teacher B

> L.19 *"Teaching is now developing more about how you learn and how you do this."*

> L.20 *"Just really getting them on board with thinking, being aware that they are learning and that they are achieving something and using their knowledge better."*

As at the beginning of the year she is still concerned to link learning to life.

> L.23 *"...a connection between what they are learning now and the bigger picture. I try to relate things to the outside world."*

Whilst it appeared to me through classroom observations and these two interviews that this teacher's style had developed on a continuum from September, she viewed herself differently:

> L.29 *"My style has completely changed. Completely. Because in September I didn't know how to teach. I'd just started, I didn't know what it was all about. It's much more focussed on learning now."*

> L.33 *"It's the learning that's important, how they are taught, what they are doing, how they've learnt it and how they've organised it, how they're communicating and to expect them to behave."*

At the beginning of the year these two newly qualified teachers, just a couple of weeks into their first teaching post gave very similar answers to questions about teaching style, both emphasising linking school learning to the child's own experience. By the end of the year, there is a more marked difference between the two. Whilst the experimental school B teacher has continued this emphasis on "child centred" learning, the control school teacher Z appears to have moved to a more routine based approach, centred on the timetable, with outside influences acknowledged as impacting on learning rather than extensions of it. For instance in response to the first question of this second interview, which picked up on responses to the first interview and asked this teacher if she still saw building on the child's own experience as important she says:

Teacher Z

> *L.11* *"I think the more they move through, I suppose, the institution of school, the less important that probably becomes. I think my children have now been in school for another year, so they've got more fixed ideas, I suppose about certain things [...] but I do think it's still really important to consider what anything that might be in their home life that might be affecting the way they look at things."*

There is a subtle difference between the views she expressed at the beginning of the year and these views. Whereas at the beginning of the year, she emphasised building on children's life experiences, she now considers the children's home life as *"affecting the way they look at things."* Out of school experiences are now seen as another variable for the teacher to consider, rather than a resource to be mined.

When asked more directly about her teaching style at the start of the year, she was unsure (unsurprisingly, given the short time she had been teaching), but she emphasised the children's personal fascinations, along with a need to teach them basic literacy and numeracy skills. By the end of the year, she emphasises the routines and structure of school life.

Teacher Z

> *L.26* *"I was going to say formal, but I don't think that's the right word, but I think the children, they have a timetable and they know the timetable and we all know the timetable and whether that's in an ideal world how they should be taught is a different matter, but we do still stick quite to the timetable."*

When asked about the *"ideal world"* situation she came back to an emphasis on child centred learning.

Teacher Z

> *L.33* *"In year one there would be an awful lot more of play or structured play and the child self directing their learning [...] I think five and six is very very young to expect them to do science and RE and handwriting, you know its quite tough, that's the way it is unfortunately."*

By the end of the year this teacher has possibly moved categories to adopt a position more in line with the "disciplined" category than the "child centred" category.

7.3 SECOND INTERVIEWS – "DISCIPLINED" GROUP

By the end of the year the experimental school teacher [C1] had left the school and she declined to give another interview. The control school teacher [Y], who at the start of the year referred very much to discipline and routine, at the end of the year gave an interesting insight into why she had responded in this way.

Teacher Y

L.8 *"I find this class very different from any other experience I've had with a year one class, because they are a low ability and I'm still working at a level that the reception class is working at."*

L.22 *"This class needs routine more than other children"*

Thus characterising her as a "disciplined" teacher only extends as far as this class and this is an important consideration to acknowledge for all the analysis of these data. She also comments on "researcher effects".

Teacher Y

L.38 *"I'd say when you are there or another researcher is there observing, it's more structured. The lessons are more structured and time is more rigid."*

L.43 *"Although you're not watching me you are still in there watching and that's a general feeling with any member of staff, if someone's in there you change it around a little bit."*

For this teacher, the structured approach she takes to teaching is determined by her perception of her class's inability to work in any other way. In addition, she is responding to being observed during the numeracy hour, by keeping to the numeracy hour format and time structure. Thus there is a consistency in this teacher's approach from the first interview in September, through the termly observations to this interview at the end of the year. However, by the end of the year she is far more forthcoming with her explanations and reasoning behind her style of teaching.

The third teacher, who at the beginning of the year was placed in this category was Teacher D. At that time she was at the other end of the continuum, in effect making it less clear whether she should be in this category, or in the child centred category. At the beginning of the year she emphasised skills. At the end of the year she emphasised children learning strategies to enable them to progress in learning skills.

Teacher D

> *L.16* *"...what I would hope that they would do, is to look for a strategy that they could use to work out their problem."*

> *L.23* *"...there are certainly some children that can apply strategies to situations."*

She then gave an example of children understanding why some add and subtract signs cannot be interchanged.

Teacher D

> *L.28* *"...but that's really a few more able children who can just visualise it in their head, what the connection between the numbers are, where I think the majority of the children haven't got that stage."*

L.37 *"Children who find it difficult to explain how they've worked it out, they don't really understand what they've done."*

This teacher also felt that she has developed her skills over the year and she now has much more in common with the "child centred" category of teachers than the "routine/disciplined" category.

Teacher D

L.61 *"... my questioning has improved so much, its got more how and why questions, questions that don't require a straight answer ..."*

L.63 *"I'm trying to encourage them to explain how they got their answer. I do give them more time to think ..."*

L.67 *"I've tried to encourage the other children to give them space to think as well ..."*

8 SUMMARY

This section of the analysis focused on describing the teachers' beliefs and opinions about teaching and learning in the year one classroom. From a thematic analysis of interviews conducted with seven teachers at the beginning of the year and one teacher mid way through the year, each teacher was assigned to one of three thematic categories:

Protective	-	emphasis on individual emotional development
Child Centred	-	emphasis on individual and group cognitive development
Disciplined	-	emphasis on practical aspects of timetable and routine

Eight interviews contributed data to the first interview session and seven interviews to the second interview session.

The major findings of this analysis were, that at the beginning of the year three teachers emphasised children's emotional development and their social skills. These teachers tended to see the children as vulnerable and adopted a "protective" role towards them. They tended to stress the young age of the children and referred to a need for more structured play in the year one classroom. By the end of the year all three teachers had changed to some extent. The growing maturity of the children meant that less focus was placed on protection. However, this is on a continuum. The experimental school teacher C2, now ensconced in the routines and structured approach of the national curriculum, still comments on the emotional vulnerability of the children in her class, with reference to them watching inappropriate adult television programmes. The control school teacher (teacher X), continues to emphasise confidence building and keeping the children happy. In contrast, the experimental school teacher (teacher A), who at the beginning of the year was probably most strongly identified with this protective category, has moved the most. She now emphasises social skills in terms of group collaboration and team working, rather than in terms of individual emotional development. She also feels that she gives children more opportunity to learn for and by themselves and she is less inclined to step in and direct and more inclined to let the children make mistakes. Thus in terms of this categorisation, she can be seen to have moved from the protective category to the child centred category.

The two teachers, one control and one experimental who were placed in the child centred category at the beginning of the year (teachers B and Z), were both, in their first teaching post, having just come out of college. They both emphasised starting from where the child is and building on the child's own knowledge. They were keen to point out how teaching should make connections between what is learnt in school and what is brought in from outside.

By the end of the year both teachers had undergone a change themselves. For the experimental school teacher (B), this seems to have been more of a development of her earlier ideas. Looking back herself, she felt she had focussed more on behaviour at the beginning of the year, when in fact she had, in comparison to other teachers, stressed a "child centred" approach to learning. However, by the end of the year she had developed both in terms of her teaching style, and in her facilitation of metacognition. She had become clearer about her own style of teaching and focussed even more on the children's learning. In particular, she had become more interested in encouraging the children to learn how to learn and to become independent learners.

In contrast, the control school teacher (Z) placed less emphasis on the children's own learning at the end of the year and more on routine and structured work. This appears to be a result of larger contextual factors, such as the structured school environment, and the national curriculum timetable. However, it seems she is aware of this change as a limitation and refers to an *"ideal world"* where the focus would be much more on the views she held at the start of the year.

Wider contextual factors were made explicit too by the control school teacher who at the beginning of the year was categorised as disciplined, (Teacher Y). At the end of the year, she clearly explains that her approach to teaching has been determined by the academic ability level of her class. She implied that, given a different or higher ability level in her class generally, her style of teaching would be different and perhaps more "child centred", in terms of these categories of analysis. Her teaching style was also influenced by my presence and she indicated that this would be the case for most other teachers too. However, there is nothing in her second interview, which explains anymore about how her teaching style might be different to the one she has adopted here. When pushed on these questions, she referred to the national curriculum, numeracy and literacy hours governing how the class is taught. The second teacher in this category (teacher C1) had severe discipline problems in her classroom and even though she advocated a more formal, disciplined style of teaching, this was not ultimately effective and she left the school.

The third teacher, from experimental school D, stressed routine and behaviour at the beginning of the year. However, analysis of her answers put her at the other end of the spectrum of the "disciplined" category from teacher Y. This was because as well as emphasising routine and behaviour she also emphasised children's learning in terms of skills. By the end of the year this skills based approach had developed into a strategy based approach, with an emphasis on children knowing and understanding something about their own learning. In this sense this teacher moved from the "disciplined" category to the "child centred" category.

Table 9.2 Summary of Categories at Beginning and End of the Year

Teacher	Beg. of year Category	End of year Category
A (Experimental)	Protective	Child Centred
B (Experimental)	Child Centred	Child Centred
C1 (Experimental)	Disciplined	n/a
C2 (Experimental)	Protective	Protective
D (Experimental)	Disciplined	Child Centred
X (Control)	Protective	Protective
Y (Control)	Disciplined	Disciplined
Z (Control)	Child Centred	Disciplined

The next section of this analysis focuses on teachers' beliefs, knowledge and opinions of the benefit of metacognition to learning.

9 WHAT TEACHERS SAY ABOUT METACOGNITION

Question 5 of the first set of interviews carried out in Autumn 1999 asked the teachers if they had come across the idea of metacognition during their teacher training or subsequent career, (see appendix 4.2).

Of the seven teachers interviewed at this time only one, (teacher A), was able to explain her understanding of metacognition as *"thinking about your own thinking"*. She had gained this knowledge through personal contact with a psychologist and through her own interest and study. One control school teacher, (teacher X), had a vague idea that it related to independent learning, whilst another control school teacher, (teacher Y), thought that it was connected with Piagetian theories of child development, but was unable to elaborate any further. The remaining three experimental school teachers and one control school teacher had no knowledge of the theory of metacognition. At this point in the interview I provided a short summary of my understanding of metacognition as including both knowledge about one's own thinking and monitoring and control of thinking, (see appendix 4.2]. The teachers were then asked if anything in this explanation resonated with them as important for children's learning.

Once given this brief explanation, all the teachers without exception, picked up on the theory and elaborated on its usefulness for children's learning. Teacher A suggested that metacognition would help children become more self reliant and enable them to solve problems. Teacher B thought that metacognition would be crucial in learning to read and that it would be important to know how you had arrived at a particular answer. Teacher C1 explained that a more metacognitive approach to teaching would lead to asking more open questions. Teacher D emphasised the need for children to stop and reflect on what they are doing. She related metacognition to what happens in the Reading Recovery Programme, which has a metacognitive element.

Similarly, the three control school teachers found that the brief synopsis I gave of metacognition resonated with their own ideas of teaching and learning. Teacher X mentioned recapping at the end of the numeracy hour and making connections. Teacher Y thought that it would enable children to build on what they have experienced, but included the caveat that this depended on their developmental stage and her present class would not be up to this kind of reflection. Teacher Z understood the theory and suggested that a metacognitive approach would encourage a conscious awareness of cognitive strategies and allow children to reflect on their own learning.

From the first set of interviews a general consensus occurred amongst the teachers, suggesting that metacognition is important for learning, and children's development, that it should be promoted and facilitated by teachers, using questioning and discussion.

In an attempt to go beyond the surface of possibly compliant answers to this question of the teachers' perceptions of the importance of metacognition for learning, later questions asked if they had any personal experience of metacognition in terms of their own learning. Thus they were asked to reflect upon themselves as learners rather than as teachers. The answers to this question fit remarkably well into the previous categorisation of the teachers into the thematic categories of "protective", "child centred" and "disciplined". Thus remaining with these categories the following pattern emerges.

9.1 THE "PROTECTIVE" TEACHERS

[Teachers A, C2 and X]

Teachers A and X related metacognition to their own studying. Teacher A said that she was aware of not being very logical:

Teacher A

> *L.55 "...so it takes me a while to get to the answer and it would be better if I could speed up."*

This teacher seems to experience metacognition as exposing a flaw in her cognitive processing. It points to something that should be remedied. Similarly, teacher X finds metacognition illuminates her perceived lack of organisation in studying, which has caused her difficulties. For her, metacognition seems rather hit and miss.

Teacher X

> *L.80* *"...you're never quite sure you know, you didn't really see why you're doing it or how it all fits in. Sometimes it comes to you and sometimes not."*

Teacher C2, interviewed in the spring term after she had taken over from teacher C1, was struggling with having to work to an unfamiliar curriculum with a difficult class and take on board the CASE@KS1 project. She found the questions about metacognition too much to answer and avoided them.

9.2 THE "CHILD CENTRED" TEACHERS

[Teachers B and Z]

The "child centred" teachers saw metacognition as an aid to their own studying. Teacher B believed that she had a *"photographic memory"* and that she became aware of this when studying for her own GCSEs, as an adolescent. She said that she always knew that she had a good memory and found tests and examinations easy. When revising for these end of school external exams she realised that she was making use of her "photographic memory" and could visualise the text book page containing the information she needed during the exam. Becoming aware of how she remembered things helped her to study more effectively.

Teacher Z said that she was aware of metacognition in terms of reflection upon her own development as a teacher. She found it useful to *"realise the gaps in my knowledge"* and thereby to direct her attention to areas that she felt were weaker.

9.3 THE "DISCIPLINED" TEACHERS

[Teachers C1, D and Y]

These teachers seemed to find the least use for metacognition. Teacher C1 viewed knowing about her own thinking as *"a worry"*, because she worried about forgetting things and felt that she read too fast and didn't take things in. Teacher D said that she was not conscious of being metacognitive at all and similarly, teacher Y said that she didn't think that people did think about what they were doing whilst they were studying.

10 CHANGE OVER THE YEAR

By the end of the year there are some marked changes in the attitudes and opinions of the teachers towards metacognition. In keeping with this thematic analysis these changes are discussed in terms of the three categories of teachers.

10.1 THE "CHILD CENTRED" GROUP

[Teachers B and Z]

From analysis of the second interview, teacher B appears to have seized the idea of metacognition and developed her teaching style around it. She referred to both the CASE@KS1 professional development training day on metacognition and support from the research team as instrumental in this development. She acknowledged that at first she had doubts about how the children would respond.

Teacher B

L.61 *"Before it was so many whys, why did you do that, and whats, what made you do that, and I didn't find those questions helpful at all, I just didn't because I'd say "why did you do that?" and they'd say "because that's the way I did it". But as soon as I asked "how do you know that's right?", "how did you get there?", suddenly all this information comes out. When I started asking questions like that it was really really unnatural, it just wasn't a question I would ask, it didn't make sense for me to ask that question. I didn't understand how children would relate to "how did you do that?" because I thought they were like building questions like I would get answers about what they had done, like "I did this and this and this", but that was what they answered to "what" questions, so when I started "how" questions suddenly they all started you know talking about how they did it in their own brains."*

This teacher is also aware that she may be getting learnt rote answers but believes that over time the children are developing cognitively, not just verbally.

Teacher B

L.86 *"It's not so much a personal experience at first, you know they just learn to say the answer to the question, but then they seem to engage with it and then they begin thinking about their own thinking in a much more personal kind of way."*

By the end of the year, this teacher feels that her own teaching style has become more facilitating of metacognition and that developing metacognition is helping to motivate the children *"in taking on board challenging ideas and thinking about them". [L.120]*

Teacher B has developed a way of questioning the children based on CASE@KS1 professional development training which aims to facilitate metacognitive experiences and combined this with practice strategies such as writing down learning intentions and regularly reflecting on what has been learnt that week. She also says:

Teacher B

> *L.140 "We often have conversations about thinking ... "*
>
> *L.146 "I give lots of rewards for thinking [...] and lots of praise for the class if they are thinking.*

She also refers directly to modelling thinking:

> *L.150 "I don't say 'hey you've learnt something new', but I do say 'hey great thought, we can use that thought' and I've done a lot of modelling about thinking."*

She goes on to give examples of this and relates how the children are now beginning to ask each other how they know something. She also believes that her own metacognition has developed as a result and that this has motivated her to continue to develop her knowledge and practice of teaching and learning.

> *L.188 "I didn't use to engage with my learning at all, I just received the information and did the tasks but since doing this I've learnt more about how to engage with my own learning."*

So even though this teacher had been successful in tests and exams throughout her own school and college career, she felt that this was down to a particularly good "photographic" memory and the ability to regurgitate required information and that this was ultimately unsatisfying in terms of personal motivation. Her enthusiasm for promoting and understanding metacognition can be seen in the context of her own personal development. She found her own metacognitive development to be motivating and fulfilling and so she has passed this enthusiasm onto her class and actively engaged with and modelled metacognition.

The other teacher in the "child centred" category, teacher Z, also newly qualified at the start of the year, appears to have become more aware of formal routines and external influences as the year has gone on, moving her away from the "child centred" category. When talking about thinking and learning she refers mostly to strategies such as reviewing learning intentions.

Teacher Z

L.89 *"I would have started, after the drawings with saying 'what do you want to find out about hearing and then at the end of the lesson I've got put up, usually the reason we are doing this is ....and my learning intention. I've got an Ofsted inspection in two weeks, so they know what the point of doing it is, but then at the end it would be very much 'hands up, who thinks they have learnt what they are supposed to learn', you get a variety of responses to that."*

L.95 R: "What sort of responses do you get when you ask those questions?"

T: "You get children who have demonstrated to me that they have understood, put their hands up saying they haven't and I also get children who I know haven't understood saying that they have, yeah, I'm not sure why, I'm not sure whether it's to get my attention."

She also goes on to say that this perverse answer to the questions only arises when she explicitly asks the question, but that these particular children never initiate saying that they don't understand something, whereas some other children will. This teacher feels that whilst she has modified many aspects of her practice since the first interview she believes she is still the same *"general sort of teacher"*. Her greatest influence on the development of her teaching style over this year has been observation by and of other colleagues in the same school. Whilst she is still keen to work from the child's own experience, building on knowledge, she has become much more aware of classroom management issues and routines, such as when to change book bags, give out homework and cover all areas of the national curriculum. In this last interview, she rarely mentions development of children's thinking and although prompted to comment on how she facilitates higher level thinking, she tends always to refer back to externals at both micro and macro levels ie. lesson planning, literacy and numeracy hours and Ofsted. She does, however, feel that she has learnt a good deal about being a teacher and about specific issues such as special needs. Still there is a sense of a growing disquiet with the external influences on her teaching.

Teacher Z

> *L.200 "I've learnt a lot about working with special needs children in a main stream setting, so things like that, but that's really just an expansion of knowledge, rather than a change in my philosophy, it's building on what I already know, if you see what I mean, it's not actually like I've gone I don't think that's the way that should be done, not really no, apart from I think the curriculum is very strict for a six year old but that's unfortunately not my option to change."*

10.2 THE "PROTECTIVE" GROUP

[Teachers A, C2 and X]

The group of teachers labelled "protective" had less to say about metacognition than did the child centred group. In particular teachers C2 and teacher X related any questions about metacognition to the children's growing emotional maturity.

There is a sense that teacher C2 coming to the project late, never really grasped the theory of metacognition and tends to avoid questions about it altogether or to interpret them as questions about the whole CASE programme. For example when asked if her understanding of metacognition has developed or changed in any way she answers:

Teacher C2

> *L.18* *"Yes it has improved. I can see it in the testing that it benefits the way they can think. I do see, you can almost see a button being pushed when they actually understand what they are looking for. I still find the grouping quite hard and the timing of the grouping."*

When asked for any examples of metacognition in her classroom she gives examples of the children displaying curiosity and growing in confidence in terms of asking more unusual questions.

Teacher C2

> *L.26* *"There was one golden moment when we were talking about bears about polar bears living in the wild or in the zoo and one boy said, 'but how would they get polar bears to the zoo?', and I just thought what a lovely question, because normally you wouldn't go beyond the thought of polar bears being in the zoo..."*

She also voices her reservations about the whole CASE@KS1 project whilst seeming to agree that metacognition should be facilitated.

Teacher C2

> *L.47* *"Yes I would have thought so.* [referring to whether it is worth spending time trying to facilitate metacognition]. *There was an interesting comment by someone who was observing a CASE activity, she said its an awful lot to ask children to imagine that an orange piece of card was the middle of a town, she thought it was too much to expect them to understand this.*

R: "And what was your feeling?"

T: "I agreed with her at that point."

This could be interpreted as another aspect of protecting the children from being pushed beyond their developmental level.

Similarly, the experimental school teacher, (teacher X), re-emphasised the need to build children's confidence and give positive feedback. In her second interview she explains that the children's growing maturity over the year now allows them to feel more confident in expressing to her, or to other children, their own understanding, or lack of understanding. She feels this has also been helped by the structure of the literacy and numeracy hour, which both call for a reflection on what has been learnt, at the end of the lesson. However, she feels that this reflective element is also intuitive.

Teacher X

L.105 "Well, it's something you do without really thinking about it..."

She has promoted a "helping each other" philosophy in her class by introducing reading to each other and commenting on each other's stories, and by having children helping other children who are struggling. This, she believes, has led her class to grow in confidence about expressing their feelings about the work. Throughout this interview this teacher continued to emphasise the care and consideration needed in teaching children of this age. She appears very sensitive to the children's emotional states and finally reiterates her earlier view

Teacher X

> *L.155 "...keep the child happy and then she will be able to learn."*

Of the three teachers in this "protective" group, experimental school teacher A appears to have changed the most over the year. By the time of the second interview, she is emphasising group skills over individual emotional development and feels that she has a better understanding of metacognition and how to facilitate it. However, closer analysis of her answers to questions about metacognition and requests for examples of her children being metacognitive show that she is really emphasising the theory of mind aspect of metacognition. For instance, her explanation of what metacognition looks like:

Teacher A

> *L.71 "Like being able to admit that another child has got another idea or see that they are looking at things from a different point of view..."*

Her examples of metacognition refer to the points of view task, a CASE task which, more than any other, attempts to facilitate and develop theory of mind.

> *L.78 "I think that points of view one, in pairs, that worked really well, cos they had to put themselves in another child's position..."*

In terms of her own development over the year, she feels that she has got better at asking questions and giving children more time to work things out for themselves.

In this sense she has moved away from the overtly protective style she manifested at the beginning of the year. At that time, she was concerned not to make things too difficult for the children and found herself wanting to give them the answer, rather than see them struggle to work it out. In terms of her own metacognition though, she still promotes a deficit view:

Teacher A

> *L.109 "I'm more aware that I don't always think about things. I'm more aware that I don't always think things through and I don't always approach things in a logical way."*

As with other teachers across the groups, teacher A finds the time constraints of the curriculum make facilitation of metacognition more difficult.

10.3 THE "DISCIPLINED" GROUP

[Teachers Y and D]

Teacher C1 having left mid way through the year was unavailable for a follow up interview.

The follow up interview with teacher Y at the end of the year is consistent with her responses to the first interview. She still feels the need for routines and discipline because she feels that her class is less able than other classes. She also believes that the external constraints of the literacy and numeracy hours prevent her from being more flexible.

Teacher Y

> *L.16 "I think that in some ways the numeracy hour doesn't allow that to arise you can't be flexible because you've got to follow it."*

However, she does relate using the plenary section of the numeracy hour to encourage the children to reflect on their learning. When asked what kinds of questions she asks them she responded:

> *L.72 "Sometimes 'what have you learnt today? or what do you think I wanted you to learn?' My more able children really like thinking that they have learnt something, the less able don't know what they have learnt and don't know how to answer that question, it's too cryptic for them."*

In her responses to the second interview this teacher placed her emphasis on the structure of the numeracy hour, which requires a reflective period at the end, saying that without this structure, even this amount of reflection would not happen. Although:

> *L.116 "Some children would think because they do think, some wouldn't whether I do the plenary or not."*

She also comments that the plenary session is:

> *L.135 "seen as important, but I don't know if it is."*

She does not expand on this or explain 'seen by who as important'. In both interviews, this teacher has been consistent in viewing her class as of low ability, in referring to the constraints placed upon teaching by the numeracy and literacy hours and in believing that very few of her class are able to be metacognitive. She also comments at the end of this interview on the absence rate in her class, which remains high.

Teacher Y

> *L.155 "I have a very high absence rate and that's got worse. My class is the worst class in the school for absence and also a high turn over of children in the class, so that affects the whole class."*

In contrast, the experimental school teacher [D], who was placed in this category at the beginning of the year has by the end of the year developed both her own awareness of metacognition and her enthusiasm for encouraging the children to be metacognitive. She makes explicit references to the CASE@KS1 professional development programme and claims that it was the mixture of theory and practice on this programme that has changed her teaching. She says that CASE professional development has made teaching both more interesting and more challenging.

Teacher D

> *L.58 "My expectations of the children are probably higher. I'm expecting them to be able to explain things together, expecting them to get to a higher standard."*

She has also come to distinguish rote answers from the children such as *"I worked it out in my head"*, from more genuine attempts to explain their thinking.

This teacher feels that she has become more aware of herself as a learner and has reflected on how she learns. She said that she uses this knowledge to try and encourage the children to reflect on their own learning. She now has a working definition of metacognition as *"knowing how you think, knowing how you learn"* and feels that she is modelling metacognition in both CASE and non CASE lessons. She has also become aware of how the children are working collaboratively and finds that often they change particular strategies in order to be fair rather than logically choosing the best strategy. For instance, when asked to invent a new game as a group, they attempted to put together a set of rules for the game by using each person's idea. In effect, this resulted in an unworkable game. However, she felt that even this failure to achieve the goal, still resulted in the children successfully listening to each other, explaining their thinking and ensuring that everyone took part. In this sense, by the end of the year, this teacher has more in common with the child centred group than with the disciplined group. She still finds the constraints of the curriculum make facilitating metacognition difficult and she particularly comments on established teaching practice, which gives little time for children to think before answering. However, she has embraced the theory of metacognition and has given a talk on metacognition to the other teachers in her school, many of who, she states, have also become enthusiastic about ways of facilitating metacognition in the children. For instance, she relates how the nursery teacher has found, that by asking her children more metacognitively oriented questions, she has enabled even those very young children to begin to talk about their thinking.

11 SUMMARY

By the end of the year there has been some development in how some of the teachers in this sample view the possibility of and importance of facilitating the metacognitive development of children in year one. The general consensus of the first interviews showed the teachers agreeing with the general idea that facilitating metacognitive development is important. This is somewhat modified by the second set of interviews, as some teachers move away from this position, to one which subscribes more closely to how the established curriculum is taught within their local context. This is particularly the case for the newly qualified teacher of school Z, who appears to have subjugated her own initial beliefs about the importance of metacognition, to the routines and external discipline provided by the national curriculum. In effect, this gives her more in common with teacher Y from the "disciplined" group, who also feels that her teaching is largely affected by external factors, such as time and curriculum constraints and in her particular case, the perceived ability level of the children in her class.

The "protective" group of teachers tended to maintain their emphasis on the child's emotional and social development. The teacher of School A moved away from emphasising individual emotional development to stressing collaborative working skills. Within this she indicated an awareness of metacognition developing through collaboration. However, the emphasis tended to be on the growing theory of mind aspects of metacognition, rather than on either metacognitive knowledge per se or monitoring and control aspects of metacognition.

In contrast, teacher B from the "child centred" group has developed her own understanding of metacognition, has experimented with different ways of facilitating its development in her class and speaks with enthusiasm about the results she has seen. Teacher D too, has developed more of an awareness and understanding of metacognition through the year, aided by her own interest and opportunity to talk to other teachers in her school. This has given her an insight into her own teaching practice and how the children are responding to her teaching.

By the end of the year, three of the four remaining CASE teachers appear to have developed greater understanding of the theory of metacognition and an enthusiasm for employing strategies that may facilitate its development. The other CASE teacher, who came to the project only half way through the year, was not seen to make this move. All the CASE teachers were aware of working under national curriculum constraints, but for the three teachers who engaged with the theory, they seemed to feel that it freed up their thinking, rather than added to the burden.

The fourth CASE teacher and the control school teachers tended to emphasise the difficulties of fitting in the demands of the curriculum and commented on the possible harmful effects of this perceived pressured learning on the children.

From this analysis of teacher interviews we would expect to find that by the end of the year three teachers, (A, B and D) would be employing more or a wider range of F M behaviours in their teaching. We might also expect that the children in these focus groups would be displaying more or a wider range of metacognitive behaviours.

Similarly, from analysis of the remaining interviews we would expect to find that teachers in the "disciplined" group and to some extent the "protective" group of teachers would use fewer or narrower F M behaviours, with their pupils correspondingly displaying fewer or narrower metacognitive behaviours those of the "child centred" group.

In order to test this prediction, the frequency counts from the tables established in chapter 7 were re-tabulated. Firstly 3 CASE tasks observed at the end of the year are analysed in terms of teacher F M and child M behaviours, (see appendix 9.2 and 9.3). Secondly, frequency counts are given for the teacher F M and child M behaviours in one numeracy lesson in the summer term, (appendix 9.4)

12 FREQUENCY COUNTS OF TEACHER F M BEHAVIOURS AND CHILD M BEHAVIOURS– COMPARISON OF EXPERIMENTAL SCHOOL TEACHERS AND CHILDREN IN CASE LESSONS – SUMMER TERM

The figures provided here are for the summer term only. These are calculated through observation of three CASE tasks in each experimental school. The tasks observed in schools B,C and D were "Shadows", "Transport" and "Farmyard", whilst for school A, the shadows task was replaced with the "Bottles" task.

Table A.9.3, (Appendix 9.2), shows that the first prediction from the interview analysis is justified. The total number of teacher behaviours coded as facilitating metacognition in the experimental schools over three tasks in the summer term of 2000 shows that teacher C2 employed far fewer of these behaviours than did the other three experimental school teachers, (A total of 16 behaviours over 3 tasks for the school C teacher against 53 for the school A teacher, 31 for the school B teacher and 33 for the school D teacher). However, as teacher C2 only joined the CASE programme half way through the year she missed out on most of the CASE training. Whilst two of the CASE teachers moved to the "child centred" category by the end of the year, teacher C2 remained in the, "protective category".

A frequency count of the children's behaviours coded as metacognitive over these three tasks in the same schools is shown in table A.9.4, (appendix 9.3). The children's behaviours more clearly justify the prediction that far less metacognitive behaviour is apparent in the focus group of school C than in the other three CASE focus groups. There is a total of only 8 children's behaviours classified as metacognitive in the CASE tasks for school C in the summer term, compared to 15 for school A, 23 for school B and 28 for school D. In addition, this low frequency count for school C is made up from only three categories: self – shows knowledge of self in relation to cognition; oth – refers to what others think/desire; che – checks work.

13 FREQUENCY COUNTS OF TEACHER F M BEHAVIOURS AND CHILD M BEHAVIOURS IN NUMERACY LESSONS OF EXPERIMENTAL AND CONTROL SCHOOLS – SUMMER TERM

In the summer term, one numeracy lesson was observed in each of the seven schools. Frequency counts of the teacher and child metacognitive behaviours observed were made, (see appendix 9.4, table A.9.5].

Observations of these numeracy lessons confirmed the prediction that control school teacher Y would use fewer metacognitive behaviours than the other control and experimental school teachers. The teacher in school Y used only 2 behaviours coded as F M, during the summer term numeracy lesson. Similarly, teacher C2 also scores very low on teacher metacognitive behaviours in these numeracy lessons, (4), although teacher D is not far behind, (6). The school B teacher scores 10 F M behaviours, largely made up from the code [TT], referring directly to her own and her students' thinking processes.

Of the "disciplined" and "protective" groups of teachers, teacher Z scores the highest, but she places less emphasis on referring to cognitive processing [TT] and more on asking students to evaluate the task they have just done [TV] or questioning how the students know the correct answer [TK]. Thus there are differences between the higher scoring "disciplined" teacher [Z] and the higher scoring "child centred" teacher, [B] in terms of the types of teacher F M behaviour they display during numeracy hours. Teacher B tends towards referring to thinking in general [TT] and to her own cognition [TC] rather than asking for evaluation, [TV]. As the observations showed in chapter 7, TV can often be reduced to a show of hands or a series of short closed questions at the end of a lesson to evaluate that day's work.

Whilst most of the experimental school teachers tended to view the facilitation of metacognition as important when interviewed, the frequency counts of F M behaviour observed in the summer term in both CASE tasks and numeracy lesson is still low. Different CASE tasks seem to promote different amount of teacher F M behaviours, with the bottles and shadows tasks generating more of these behaviours than either the farmyard or transport task.

The frequency counts of child M behaviours in the numeracy hour of the summer term, (appendix 9.4, table A 9.5), also support the prediction from the interview analysis that students in schools C and Y would display less metacognitive behviours than those in the other schools.

14 DISCUSSION

Conducting semi-structured interviews with five experimental school teachers and three control school teachers both prior to and after the CASE@KS1 intervention programme sought to answer the following questions:

1. Do teachers' beliefs and opinions about teaching and learning affect the way they try to facilitate metacognition in the classroom?
2. Does teachers' knowledge of and beliefs about metacognition impact on the development of metacognition in the classroom?
3. Can teachers' ability to promote metacognition be developed through CPD?

Analysis of the initial interviews revealed three styles of teaching which were labelled "Protective", "Child Centred" and "Disciplined". From the initial interviews three teachers (schools, A, C2 and X) were categorised as "protective", two teachers (schools B and Z) as "child centred" and three teachers (C1, D and Y) as "disciplined". By the end of the year there had been some change in the teachers' styles of teaching and in their knowledge of metacognition. Two teachers (schools A and D) had now much more in common with the "child centred" category, whilst teacher Z, initially in the "child centred" category, by the end of the year had more in common with the "disciplined" category. However, the categories were not seen as fixed, but involving a continuum from strong to weak examples of the category. Thus frequency counts of teacher F M behaviour show a good deal of individual difference across the categories.

A comparison of the frequency counts of teacher F M behaviours and child M behaviours at the end of the summer term showed that in general teachers in the "child centred" category, (now teachers A,B and D) employed more and a broader spread of F M behaviours than did the "protective" teacher. However, different CASE tasks had an effect on both the teacher F M and child M behaviours found. The CASE tasks observed during the summer term appeared to facilitate fewer teacher F M and child M behaviours than other tasks such as clowns and picture stories.

The tables show that there were individual differences amongst teachers and tasks in the quantity and spread of teacher F M behaviours observed. Teachers A and D ("child centred"), had high numbers of teacher F M behaviours in two of the CASE tasks, but this did not transfer to the numeracy lesson. Whilst teachers expressed positive views about the importance of metacognition for learning during the interviews, these opinions did not transform their practice in every case, during observed lessons.

However, the three experimental school teachers in the "child centred" category at the end of the year, whilst having low frequency counts on F M behaviours in the numeracy hour still had a slightly greater spread of teacher F M behaviours than the "disciplined" or "protective" teachers. The highest frequency count amongst the "disciplined" teachers was by teacher Z who was originally placed in the "child centred" category, but who by the end of the year tended to stress more discipline, structure and routine aspects of teaching.

In terms of metacognitive knowledge those teachers who engaged with the theory and communicated their enthusiasm for it (teachers B and D) had higher counts of child M behaviour during CASE lessons in the summer term.(23 and 28 respectively, against 15 and 8 for the other two teachers) These child behaviours also covered a wider range than did those of the children in the other classes in both CASE and numeracy lessons. This finding is shown more clearly in the qualitative examples of the group work of children in these two schools given in chapters 7 and 8.

The school A teacher's knowledge of metacognition developed over the year as she moved from her "protective" style of teaching to a more "child centred" style. However, in the interviews she tended to stress the theory of mind aspects of metacognition and in this sense she was still concerned with children's emotional and social development, rather than their cognitive development. Whilst she did try to model thinking and asked questions about how students had gained knowledge of something, her emphasis was on listening to and understanding another's point of view.

From comments by teachers B and D it seems clear that the CASE@KS1 professional development programme had influenced their knowledge of and enthusiasm for promoting metacognition in their classrooms. The only experimental school teacher seemingly unaffected by the programme, in terms of metacognition, (teacher C2) joined only half way through the year and appeared to have so many other things to contend with, that the whole CASE@KS1 programme was seen as an extra thing to do. It is not surprising that she did not understand the theory or attempt to put it into practice, especially since she received less than half the CPD experience.

Conversely, the control school teacher Z at the start of the year appeared to understand the idea of metacognition and was able to elaborate on my description and relate it to her own ideas of developing children's thinking. By the end of the year with no access to the professional development programme her knowledge had not progressed and she tended to stress other aspects of learning such as discipline and routines. However she did still manage to have a relatively high count of teacher and child metacognitive behaviours at the end of the year.

With the exceptions of schools Y and C, the frequency count for child M behaviours in the summer term numeracy lesson across the other schools ranged from 5 to 10 instances. This is both low and consistent for the numeracy hour. Similarly, teacher F M behaviours were fairly consistent (with the exception of schools Y and C) in the numeracy hour at between 6 and 10 instances.

The analysis has shown that whilst teachers can assimilate the theory of metacognition from a professional development session and translate this into practice within their classrooms, their use of this behaviour is affected by the task.

The more receptive teachers in this programme, in terms of metacognition theory already held views of teaching and learning, which concentrated on cognitive aspects of children's behaviour, of problem solving and of the importance of thinking. In addition, by the end of the year they had changed or developed their ideas about their own metacognitive ability, seeing it as an important aspect of their teaching to reflect upon themselves as learners. In this way teacher B, of all the teachers, tends to model metacognitive thinking. She was particularly enthusiastic about showing her students how she thinks about her own thinking and how that helps her to solve problems. Whilst she does not score the highest on teacher F M behaviours, she is reasonably consistent in her behaviour across tasks, including the numeracy hour. Teacher D also makes this leap by the end of the year, using her ability to reflect on her own thinking as a model to encourage metacognition in her pupils. These teachers, by the end of the year, have found the ability to step back, to let their students work out the problems together and to facilitate, rather than protect their students in their cognitive and social development.

The analysis shows that teachers' knowledge of metacognition can impact on the development of metacognition in the classroom but as shown by the frequency tables, this does not always transfer out of the context in which it is learned, at least not within one year. Thus there is no discernible increase in metacognitive behaviours in the numeracy lessons. It seems then that more support and more input is needed on the theory of metacognition and strategies for facilitating it in contexts other than CASE@KS1 tasks.

Teachers' beliefs and opinions about teaching and learning were seen to influence their facilitation of metacognition with an emphasis on routines, structures and external constraints being the least productive in terms of positive metacognitive behaviour. Whilst as chapter 8 suggested, some level of emotional involvement with the task is necessary for true engagement, an over emphasis on emotional states of individuals, tends to hamper metacognition and children then make decisions based on this emotional context rather than on what would work best.

This chapter has focussed on the teacher's role in the development of metacognition in these five and six year olds. The next chapter will bring together the results from the metacognitive tests, the classroom observations, the individual case studies and this analysis of the teachers to describe what metacognition is in year one children and what affects its development.

Chapter 10

SUMMARY AND CONCLUSIONS

1 INTRODUCTION

The first part of this chapter will summarize the findings from the empirical data. This research project has used a mixture of methods and approaches to investigate metacognition in five and six year old children.

The starting point was a personal interest in self-regulated learning, which developed from experience of teaching both traditional academic and vocational subjects to post school students. A frustration felt from a seeming lack of ability of a good many students to reflect on their own cognition and learning, even though they appeared motivated to learn, led to a general interest in the area of metacognition.

Many years later the opportunity to investigate metacognition in young children was presented in the form of a major research project, designed to accelerate the cognitive development of five and six year old children. The CASE@KS1 project was so structured that the facilitation of metacognitive processing was an integral part of the intervention programme.

An initial interest in whether CASE@KS1 would be successful in enabling children of this age to develop metacognitive processing, led to more complex questions about what is meant by metacognition. Existing theories of cognitive and metacognitive development have tended to view metacognition as late developing. Thus this project needed to address the wider issues surrounding theories of metacognition and its development.

The main CASE@KS1 project and thus this project was based in an educational context funded by a local education authority and relied on the goodwill of teachers and other school staff, parents and most of all the children concerned. In addition to answering the research questions this project hoped to provide descriptions of metacognition occurring in classrooms which could prove beneficial as examples for teachers in the future.

The second part of this chapter, The Conclusion, will discuss the findings related to the wider context of theories of metacognition. This research has used a mixture of research methods and paradigms appropriate to the different nature of each research question. Methodological issues, which arose during the project, are discussed. Finally, The Conclusion outlines themes that have emerged, relates these to recent literature on metacognition and suggests areas for future research on metacognition.

2 SUMMARY OF EMPIRICAL DATA

Chapter 6 addressed the following questions:

Research Q1: Can metacognitive ability be enhanced?

a) How is metacognition conceptualised for this research ?

b) What is metacognition for five to six year olds ?

c) How can metacognition be measured ?

d) Does CASE@KS1 as implemented impact on any factors of metacognition

Research Q2: Are metacognitive gains related to cognitive/academic gains?

a) What are cognitive gains for this project?

b) What are academic gains for this project ?

c) To what extent are these measurements clouded by other variables ?

Theoretical literature had suggested that metacognition involves both stored metacognitive knowledge (akin to declarative knowledge "knowing what") and monitoring and control processes (akin to procedural knowledge "knowing how"). In addition, theories of metacognition suggested that it involved different factors.

The research presented in chapter 6 aimed to test some of these theories of metacognition and to find out what it means to be metacognitive at the age of five or six. In addition, as the main CASE@KS1 project aimed to develop metacognition along with cognition in the experimental group of children, tests were designed to measure any growth in metacognitive processing over the year.

Four tests of metacognition were devised and children were tested at the beginning and end of the year. Results were given for 21 experimental school children and 16 control school children. As the data produced by the tests was categorical, chi square tests using gain scores were carried out for each test. Test 1, Self as Learner, showed no significant difference between the experimental and the control group. Whilst children did become more aware of themselves as learners over the year, this appeared to be a result of maturation and the normal school environment. The specific intervention of CASE@KS1 project had no greater influence on this developmental process. Test 2 covered the area of Theory of Mind and included two different tests. The first was a classic theory of mind test (Smartie Tube) administered to all the children at the beginning of the year. As this test reached ceiling, the literature was searched for tests, which may distinguish between different levels of theory of mind. An interpretative theory of mind test (Droodles Test) was used at the end of the year, along with another classic theory of mind test (a version of Maxi and the Chocolate). As expected, the Maxi test reached ceiling at the end of the year, confirming the results of the Smartie Tube test and indicating that all the children in the sample had this basic theory of mind. However, the Droodles test showed a large difference between the experimental and control groups (43% of the experimental group scored 2, whilst only 6.25% of the control group scored 2). This suggests that the experimental group had, by the end of the year, developed an interpretative theory of mind as described by Carpendale and Chandler, (1996). It is difficult to ascribe this difference unequivocally to the CASE @KS1 intervention because this test was not administered at the start of the year. However, the need to explain one's thinking and to understand that others may hold different views are fundamental aspects of the CASE@KS1 programme and it seems likely that practice over the year in thinking about and verbalising these aspects of cognition has had some effect.

The third test was of metamemory and sought to test children's understanding of memory and knowledge of memory strategies. The explanations the children gave about how they remembered a number of objects and about what they know about their own memory were categorised and scored. The results showed that whilst the two groups scores were similar at the pre-intervention stage, at the end of the year there was a large difference. Over 90% of the experimental group scored above 5 whilst only 37.5% of the control group did likewise. Results of a chi square test using gain scores was significant suggesting that CASE@KS1 had a positive effect on the experimental group's ability and/or willingness to reflect upon and explain this cognitive process.

The final test of metacognition challenged the children to use mental rotation strategies, to solve a visual problem and to explain these strategies. At the beginning of the year the majority of both experimental and control groups failed this test in terms of performance and explanations. By the end of the year, there is some increase in the success rate of both groups, however still the majority of children in both groups failed the test. In general, the control group scored better than the experimental group but this didn't reach significance. However, some children in the control group scored less on the post test than on the pre test. From these results it seems clear that the CASE@KS1 intervention has not impacted on the development of the children's ability to explain how they solve mental rotation problems.

In order to understand the connection between cognition and metacognition the gains for each test were correlated with gains on tests of conservation and a spatial perception test as well as with end of year 2 national tests in language and numeracy. There was no significant correlation found between metacognition and cognition or metacognition and academic results as measured by any of these tests.

Results of Spearman Rank correlation for all four tests of metacognition showed no significant correlation between the tests. This suggests that rather than tapping one general factor, called metacognition, these tests were possibly tapping distinct metacognitive abilities.

Chapter 6 introduced a particular qualitative analysis of the data in order to gain some understanding of what metacognition is for five and six year old children. The term is problematic since most early theories of metacognition tend to view it as analogous with a high level of abstract thinking. However, recent literature from developmental, social and cognitive psychology has shown that young children can be aware of their own thinking and can explain their reflections to others, (Bartsch & Wellman, 1995; Edwards & Mercer, 1987; Flavell et al., 1995; Hockaday, 1984; Kontos, 1983; Mercer, Wegerif, & Dawes, 1999).

Phenomenological descriptions of metacognition were created from the transcribed test/interview data. These descriptions indicate how children of this age describe their own thinking. In using their own language, but viewing this through a psychological lens, the re-created general phenomenological descriptions provide qualitative evidence for young children's ability to be metacognitive. These data show that the young children in this study make clear and distinct differences between different types of cognitive activity. The majority of them were able to talk about remembering and to provide theories how their memory might work. Some, though not all, were able to articulate notions of learning and an understanding of others as cognitive beings. However, they were less able to describe their own problem solving abilities in the mental rotation task and this may be linked to their inability to solve this type of task. The rich descriptions from the phenomenological analysis show that metacognitive knowledge about memory and remembering is the clearest of the four types of metacognition tested.

Chapter 7 sought to answer the following research question:

Research Q3: How is metacognition facilitated in year one classrooms?

a) Is metacognition apparent in year one classrooms?

b) What do teachers do to effect metacognitive processing in pupils?

c) Are teachers successful in provoking metacognitive responses from pupils?

d) What other variables affect the development of metacognition in year one classrooms?

This chapter reported on classroom observations of both CASE and numeracy lessons, which were carried out over the year in both the experimental and control schools. The observations concentrated on the children who were given the tests of metacognition at the start and end of the year. The aim of these observations was to understand more about how metacognition is facilitated in year one classrooms by observing both teachers and children as they worked through CASE@KS1 tasks.

The observations were analysed using both a theoretical approach based on Flavell's theory of metacognition (Flavell, 1979) and a grounded approach, where the data were searched for instances where teachers appeared to facilitate or encourage metacognition. The analysis aimed to investigate if anything that could be categorised as metacognition, was apparent in the observed lessons and then to consider both the teacher's role and the impact of other variables on any instances of metacognition found.

The result of this analysis was that, overall instances of metacognition were infrequent in both control and experimental groups. Teachers rarely asked children to predict results, to plan their work or to check their results. They rarely referred to self-learning strategies and what children could do if they became stuck on a problem. However, both groups of teachers more frequently referred to thinking in general, and they tended to ask questions about strategy use, knowledge and beliefs. Whilst there were less teacher behaviours coded as facilitating metacognition in the control schools than in the experimental schools, there was some individuation between teachers, suggesting that teachers' own beliefs, opinions and knowledge of metacognition is a factor.

In addition different tasks tended to encourage a different range of metacognitive behaviour. The tasks which consistently engaged children in more and a wider spectrum of metacognitive behaviours were the buttons sorting task, the story tasks where pictures had to be sequenced into a story and the puzzle type tasks of clowns and bottles. It may be that the sorting and story tasks produce more metacognitive behaviour because they have a relatively simple task structure, which is already familiar to the children. This would lessen the cognitive load on working memory, allowing the children to think more about how they are doing the task, than seeking a solution to it. These tasks are also relatively open ended, with more than one solution equally valid. Thus the children can engage in explaining and justifying their own thinking to the others in the group. The clown task and the bottles task provided a more problem solving scenario. It may be the curiosity value of the problem, which motivates the children to engage in thinking about planning, predicting, evaluating and monitoring their thinking as they begin to realise that these aspects are necessary in order to achieve the goal of a collaborative solution.

Chapter 7 also provided information about the normal year one curriculum. Observations carried out in the numeracy hour in both experimental and control schools showed that the numeracy hour provided less opportunity for metacognition by both teachers and children than did the CASE@KS1 tasks. Both child M behaviours and teacher F M behaviours in the numeracy hour were found to cover a more limited range than the CASE lessons. Experimental school teachers engaged in only slightly more F M behaviours in numeracy lessons than the control school teachers, although there was some individuation. However, the experimental school teachers did use a broader range of F M behaviours in the numeracy lessons than did the control school teachers. Thus there may be some transfer of CASE professional development training from CASE activities to other teaching. However, in general it seems that one year is not enough for the CASE teacher programme to enable teachers to transfer CASE pedagogy to other areas of their teaching.

Sometimes large counts of a particular FM behaviour were a result of teachers repeatedly asking children the same type of question, for example, whether they had found the work difficult or easy. This type of question tended to occur at the end of the lesson and often resulted in simple answers or a show of hands rather than any more meaningful reflection. Such results indicated a limitation of the frequency count method of analysing complex situations, and showed the need for a more qualitative analysis to support the quantitative method.

In order to gain a deeper understanding of the way children begin to develop metacognition, an analysis was made of the interactions of three individual children with their groups. Chapter 8 reported on this qualitative analysis and suggested that the need to explain one's thinking, the use of metacognitive strategies such as planning, evaluating and predicting and developing a knowledge of oneself and others could be encouraged through structured collaborative group work as used in CASE@KS1.

Both logical rational thinking and emotional affective thinking were found to provoke metacognitive behaviour. The chapter argued that it is through interaction with others, in pursuit of a common goal, that children can be helped to have metacognitive experiences, which will facilitate the development of metacognition (Flavell, 1979). Metacognitive development occurs within a social and intellectual context. In terms of the classroom the teacher is initially responsible for providing an environment in which metacognitive experiences can occur and in which children can practice and develop metacognitive skills.

The CASE@KS1 programme placed a great importance on providing the teachers with both theoretical and practical knowledge of the programme. Implications of the findings of this research for pedagogy are discussed on page 432 Chapter 9 aimed to investigate the following research question:

Research Q4: What factors, associated with teachers, impact on the development of metacognition in year one classrooms?

a) Does teachers' knowledge of and beliefs about metacognition impact on the development of metacognition in the classroom?

b) Do teachers' beliefs and opinions about teaching and learning affect the way they try to facilitate metacognition in the classroom?

c) Can teachers' ability to promote metacognition be developed through CPD?

Through a thematic analysis of semi-structured interviews with both control and experimental school teachers, three "types" of teaching were identified. These were labeled, "protective", "disciplined" and "child centred". Individual teachers were found to loosely fit into one of these styles in terms of facilitating metacognition. Chapter 9 clearly points out that teachers were found to range widely within these categories and the categories were viewed as nominal rather than prescriptive. However, the important finding reported in chapter 9 was not so much the naming of categories but the extent to which teachers changed throughout the year. Particularly interesting was a control school teacher who became more disciplined, and an experimental school teacher who developed her teaching for metacognition along an affective trajectory, which resulted in her stressing the theory of mind aspect of metacognition, rather than rational logical thinking. One teacher in particular, from school B, appeared to develop her own metacognition during the year, as well as enthusiastically embracing the theory. She managed to create high quality metacognitive experiences for the children in her class. This was clear from the consistency of the results of the frequency count of teacher F M and child M behaviours described in chapter 7 and also from the qualitative analysis of classroom observations of both CASE tasks and to a lesser extent numeracy lessons throughout the year.

Analysis of data in chapter 9 shows that the teachers' own personality, their engagement with the theory of metacognition, their beliefs and opinions as to its usefulness led to different amounts or different kinds of metacognitive experiences for the children in their classes.

3 LIMITATIONS

This research project is, by necessity, limited in method and scope. Firstly, the initial sample size of 24 children in four experimental schools and 18 children in three control schools is small for undertaking any kind of statistical analysis. Secondly, the four tests used to provide data on different factors of metacognition were not balanced in terms of difficulty, nor were they standardised in any formal way. The tests were used to provide a stimulus for children to talk about their thinking and the correlation of gains with other test gains can only be tentatively drawn. However, an attempt was made to administer the tests in a uniform manner at both pre- and post test stage.

The classroom observation data was subject to categorisation and frequency counts, thus turning essentially qualitative data into numbers. This of course involves issues of reliability in coding and highlights the problems of individual differences. An attempt was made to address these problems by learning from the analysis of the pilot phase data and changing the analysis method to include both a theory driven and a grounded approach. The unit of analysis became the CASE or non CASE lesson and individual differences were explored through focussed case studies of particular children. The coding of the observational data was also subjected to an inter-rater reliability check.

The teacher interviews also highlighted methodological issues. Practically, it was difficult to interview a number of teachers in one day, but this was the only opportunity to speak to them. Chapter 9 made claims for some change in teacher behaviour over the year through analysis of this interview data. Whilst field notes and classroom observations supported this finding, it is also possible that other variables had an effect. It is possible that over the year, the teachers became more relaxed in my presence and relationships began to develop. Thus some portion of the interviews, such as expressing their opinions openly, may be affected by social and emotional factors. However, this is the case with all research that involves repeated interviews. Thus the findings from chapter 9 need to be viewed in the light of the observational data provided in chapters 7 and 8.

Whilst this project has sought to use a variety of methods to investigate metacognition, it is by viewing the results of all the methods of analysis used, that conclusions are drawn. The aim was to allow qualitative methods of analysis, such as the phenomenological descriptions, to add depth to the quantitative data. Thus whilst one method alone may be very limited, by approaching the subject from different perspectives and interpreting different sets of data it is hoped that a more reliable interpretation of the phenomenon can be given.

In terms of scope, many variables, which are likely to impact on the development of metacognition, especially home, and family influences were outside the scope of this project. Equally children's friendships within school, which could possibly have highlighted areas of social and emotional metacognition, were not formally explored. Both time and access were limiting factors.

One of the difficulties faced throughout this project has been the question of, how do we know what six year olds mean? Language has played an important role in the whole of this project and yet to some extent it has been sidelined. Whilst analysis of verbal interactions has provided the backbone of the whole project, many of the philosophical issues associated with language research have not been pursued. This is largely due to the need to focus on metacognition as an internal process and not allow language to become the focus of the project. However, where pertinent and where I felt something about language needed to be overtly stated this has been done.

4 CONCLUSION

This research sought to answer four main research questions:

Q1: Can metacognitive ability be enhanced?

The results of both quantitative tests and observational data suggest that metacognitive ability can be enhanced in some areas and with some caveats (see below). The results of the metamemory test suggested that the CASE@KS1 project had a positive effect on the development of metamemory in the experimental school children, over the year of the project. It also seemed likely that the CASE project had a positive effect on the development of an interpretative theory of mind for the experimental school children. However, there were some individual differences amongst schools and amongst individual children. Data from classroom observations suggested that the experimental school children used more and a broader selection of metacognitive behaviour than the control school children. By the end of the project, observational and interview data suggested that there was some transfer of metacognitive behaviour from CASE lessons to other areas of the curriculum.

Research question 2 asked:

Q2: Are metacognitive gains related to cognitive/academic gains?

The results of correlation between metacognitive tests, tests of conservation and spatial awareness and UK national tests in language and mathematics found no significant relationship between metacognitive gains and cognitive/academic gains. Factors influencing these results were discussed in chapter 6.

Research question 3 asked:

Q3: How is metacognition facilitated in year one classrooms?

Classroom observational data suggested a number of teacher behaviours, which were facilitating metacognition and providing metacognitive experiences for the children. Child metacognitive behaviours were found to be a result of high quality interactions with teachers and peers and were affected by the type of task set.

Research question 4 asked:

Q4: What factors, associated with teachers, impact on the development of metacognition in year one classrooms?

Interview and observational data suggested that teachers' beliefs, opinions and knowledge of metacognition affected their facilitation of metacognitive experiences in the classroom. Teacher's wider views on learning and pedagogy also appeared to affect the metacognitive environment of the classroom.

Subject to the limitations discussed previously, the main findings of this research project are that:

1. Five and six year old children can engage in some forms of metacognitive processing and can use simple metacognitive skills to achieve a goal.

2. The development of any metacognitive processing depends upon the quality and type of metacognitive experiences that children have, which in turn, rely on the construction of a metacognitive environment.

3. Both peer interaction and adult intervention are necessary to develop metacognition.

4. The facilitation of metacognition takes time and requires tasks where the thinking through is at least as important as getting an answer.

5. Metacognition is often difficult to facilitate, can be interpreted in different ways and can lead to confusion between cognitive and metacognitive processes.

6. Problems with measuring metacognition make it difficult to provide strong evidence for the impact of metacognition on academic performance.

7. Metacognitive processing involves both cognitive and affective factors and not all metacognitive reflection is necessarily positive.

8. Whilst social metacognition appears to be a naturally occurring developmental process, metacognition related to more specifically academic learning, requires support.

9. This particular research suggests that metacognition is not a unitary construct but that there are a number of different relatively independent factors.

5 IMPLICATIONS OF THE FINDINGS

5.1 THEORETICAL IMPLICATIONS

The findings of this research project suggest that the features of metacognition tested ie. metacognitive knowledge about the self as a learner; metacognitive knowledge about others as cognitive beings; metacognitive knowledge about memory and remembering and metacognitive knowledge about problem solving develop at different rates. Young children can reflect upon and speak about themselves as learners and about their own memory processes. Whilst an understanding of the false belief aspect of theory of mind has developed by the age of five, the more complex interpretative theory of mind has not fully developed in all children by the age of six. The interpretative theory of mind test indicates whether children understand that different people when exposed to the same stimulus can have different views or reactions to it. The results of this test showed that by the age of six there is still a great deal of individual difference between children's ability in this area of metacognition. It is this understanding of theory of mind which forms a basis for people to communicate their ideas effectively, to argue or defend their point of view and to weigh up the evidence for competing positions as Kuhn as pointed out, (Kuhn & Dean, 2004). Thus whilst some basic aspects of metacognitive knowledge have developed by the age of five to six years, more sophisticated metacognitive processing may need to be encouraged through specific learning environments. Theoretical models of metacognition need to take into account the different developmental time lines of different aspects of metacognition. A model showing the relationship between what has developed by the age of five or six and what is in the process of developing could to lead to specific educational interventions targeted at these particular transition points.

The results of much of the research into metacognition undertaken over the past two decades has produced a view of metacognition as a function of a mature, rational, logical mind and as Whitebread points out this produces a model of metacognition which emphasises what children cannot do, rather than what they can, (Whitebread et al., 2005). Thus attempts to teach children to be more metacognitive has led to fears about unnaturally pushing young children into reflective modes of thinking, when they are naturally active, unreflective beings (Simms, 2001). However, evidence from the phenomenological analysis of children's views of different aspects of thinking indicates that given the chance to do so, young children can reflect upon their own and others' thinking and can give quite sophisticated and complex ideas. For instance children of five to six years old expressed such complex ideas as *"we can learn by watching others but we cannot remember that way"* and *"remembering is not easy and knowing that you have forgotten something makes you feel sad"*, as well as expressing what they don't know. They suggested that how things get into memory is a mystery but they know when they are there.

Whilst this project used Flavell's original framework of metacognition (op. cit) to produce a coding system of classroom interactions, the results of the classroom observations show that Flavell's original model needs to be re-constructed with a greater emphasis on the social construction of metacognition. The classroom observations showed that metacognition can be developed through group collaboration by reflecting on others' thinking as well as on one's own.

Conceptual models of metacognition need to describe how these "bottom up" processes of reflecting through group interactions link with the "top down" individual stored metacognition and go on to influence the development of more sophisticated metacognitive processing. Evidence from the three case studies in this project suggest that the group interactions do influence individual metacognitive development, but only longitudinal studies will show the extent to which this development is stable and secure. My suggestion is that this development is unlikely to be secure at this age and that in order to facilitate the development of secure and stable metacognition consistent metacognitive environments are necessary.

New theoretical models of metacognition also need to take account of individual differences, both in terms of cognitive aptitude (Corkill, 1996) and socio-economic differences (Pappas, Ginsburg, & Jiang, 2003). These factors appear to affect the extent to which children use metacognitive processing and are able to express themselves in the appropriate related language. In addition, recent work on the connection between metacognition and intelligence suggests that metacognition in terms of metacognitive skill is at least partly independent of intelligence and is a general person-related characteristic, rather than domain specific, (Veenman et al., 2004).

Thus new conceptual models will need to incorporate these types of individual factors and be broadened to include the range of affective factors such as motivation, individual personality traits and even emotional reactions to learning environments. The range of data analysed for this project suggests that all these factors can affect the metacognitive behaviour of children in the classroom. The classroom observations showed that in order to facilitate metacognition, metacognitive environments where children feel secure and able to express their thinking and reflect on their understanding need to be created.

5.2 IMPLICATIONS FOR PEDAGOGY

If metacognitive environments are to be created in order to help children develop positive metacognitive knowledge and regulate their own thinking then teachers need to be fully conversant with the theory of metacognition and how it can be facilitated. The research for this project suggested that teachers' opinions, beliefs and knowledge about metacognition influenced the type of metacognitive behaviours they facilitated in their classrooms. Whilst the sample of teachers in this study was small and the broad classifications into three types of teacher was a simplification, the study nevertheless showed that a relationship did exist between teachers' attitudes to teaching and the creation of a metacognitive environment.

The professional development of teachers, how teachers react to intervention programmes, how teachers change and develop and how teachers affect their pupils' learning is a huge theoretical field in its own right. Briefly, there appears to be a range of views of how teachers should be trained from apprentice type schemes, to the more theoretically driven approaches, to the more individualistic reflective practitioner approach. Whilst personal reflection in any professional field would seem to be a good idea and certainly helps in the development of individual metacognitive knowledge, there is the danger as Furlong points out (Furlong, 2000) that self-reflection may undervalue the existing theoretical knowledge about teaching. It is possible that the self-reflective practitioner could become stuck in a self-referential loop without regard for external evaluation. However, the other side of this coin is that a total reliance on evidence based practice simplifies the complex teacher/pupil relationships. In providing recommendations on how teachers can facilitate metacognition in their classrooms these two competing approaches need to be considered.

Firstly, it was evident from this research project that most of the teachers knew nothing about metacognition at the start of the programme. During the CASE professional development programme only one half day was given over to the theory of metacognition and whilst some teachers took a personal interest and pursued their own learning about the theory, others did not. As the CASE@KS1 programme last for only one year it may be more important for teachers to be given theoretical input on metacognition at the start of the year and to continue to develop their knowledge through workshops with the teacher tutors during the year. The use of reflective diaries (as originally conceived on the research programme, but later dropped) may prove a good way for teachers to map their own metacognitive development.

However, product-process models of teaching and learning, which attempt to relate (either as correlation or causally) teachers' behaviour to children's attainment, have come in for a great deal of criticism from as far back as the 1970s to more recent years, (Doyle, 1977; Fenstermacher, 1979; Gardner, 1974; Richardson, 1994). Yet evidence from classroom observations from this project showed a link between the types of questioning and the interactions the teachers had with the children and the range and quantity of metacognitive behaviour the children displayed, (see tables A.9.3-A.9.5). The analysis of this data showed that teachers need to be helped to facilitate metacognition in their classrooms. It would seem difficult for them to do this without some knowledge of the theory of metacognition; of why it is important for learning and what kinds of behaviour facilitate or hinder its development. Thus a theoretical input on metacognition and examples of classroom behaviour where metacognition is apparent (such as those given in this project) would be a good beginning.

However, as chapter 9 showed, the teacher's own ability to be metacognitive will impact on how and to what extent she facilitates metacognitive behaviour in the classroom. As Clarke has pointed out reflection on practice is an active rather than a passive process. Teachers "*need to become articulate, to be communicative, or to use thoughts as objects of systematic attention with their colleagues*" (Clarke, 1994 p.44). In this latter sense teachers need to become metacognitive themselves (as did teacher B in this project), in order to fully facilitate metacognition in their pupils. The move, it seems to me, is one from teacher as professional practitioner to teacher as life-long learner. In order to create metacognitive environments in which pupils are encouraged to explore and play with their own thinking, teachers need to be seen to be doing the same thing, to not only model the language of metacognition, but to be fully engaged in metacognitive interactions.

In addition, just as the pupils in CASE lessons work collaboratively to solve problems and develop their thinking so teachers could benefit from collaboration with their peers on the problems of creating metacognitive environments which will benefit all the pupils in the class, with all their individual differences.

6 RESEARCH INTO METACOGNITION

This research project has purposely used a mixture of methods to research metacognition and has drawn on a range of methodologies. In doing so it has employed established quasi-experimental and quantitative methodologies to confirm previous research findings and to attempt measurement of metacognition. In addition to reaching conclusions about the nature of metacognition, this thesis has also explored methodological issues, in particular, the application of phenomenological approaches. Along this journey into different methodologies, many problems and obstacles have been met and explored. Some of these, such as the problem of measuring an internal mental process through categorisation of what someone says, are specifically tied to the concept of metacognition.

Measurement of any mental process is fraught with difficulties of validity and reliability and cognitive researchers come up with more and more ingenious psychological tests to try and reduce the variation in individual factors. This type of research continues through the work of special interest groups, such as the metacognition group of EARLI, along with the work of individual researchers.

This project has developed a unique framework for categorising classroom behaviour as metacognitive, which uses both a theoretical approach and a grounded approach. This framework can be used as a basis for more detailed analysis of one or more aspects of metacognition. It may also prove to be useful to other teachers as examples of young children displaying metacognitive processing in early years classrooms, and as examples of how some teachers have tried to provoke metacognitive experiences in young children and support the development of metacognitive processing.

Throughout the project the particular research question has determined the method used. The qualitative analysis of classroom interactions, in particular the use of case studies to produce more detailed analysis of individual children, showed children developing an increasingly sophisticated way of thinking about problems. The snapshots of children working together, exchanging thoughts and constructing new ideas as a result of interactions with their peers provided evidence that children as young as five and six years old can engage in both rational, logical problem solving and reflect on their thinking process.

The evidence from one to one contact with the children plus observing them interacting with their teachers and peers has suggested that whilst they do copy each other and construct answers to questions spontaneously, they can also maintain their beliefs and opinions and use argument to persuade others. By the end of this project, I came to view these children less as easily manipulated participants in terms of language and more as knowing and increasingly sophisticated users of language in their own right.

This project has also addressed ethical issues of conducting research with young children. Throughout the year issues such as consent, power relations and confidentiality were assessed and reassessed. As the project progressed so relationships were built and children and teachers appeared to become more like collaborative researchers than observable phenomena. By the end of the project all four experimental schools appeared enthusiastic about the research. Children were interested to talk about their thinking, teachers asked for reading on metacognition and in some schools, other members of staff actively sought to engage in conversations about metacognition with me.

The qualitative evidence from this project suggests that nothing is to be gained by narrowing the concept of metacognition just to include fully formed abstract thoughts about thinking, which are competently transformed into speech or actions which are then measured. Whilst distinctions do need to be made between cognition and metacognition, future research from an educational point of view might best be focussed on how environments can be created in everyday classrooms, where thinking is valued in and for itself. From the findings of this research it appears that young children have a naturally developing theory of mind and metacognitive processing which can be built upon, prized and developed through careful nurturing. The social metacognition that children often readily engage in can be made more explicit, so that peers help to construct positive metacognitive beliefs amongst themselves. The only way to change classroom environments however is through the teachers and other adults who control them. Thus future research may need to build on the research into teachers' beliefs, opinions and knowledge of metacognition presented here.

In terms of theoretical research there is still a great deal of scope for exploring the developmental trajectory of metacognition not just in children but throughout the life span. The differences and similarities between cognitive and social aspects of metacognition could be further elaborated. Whilst the pursuit of reliable and valid tests of metacognition is an important and noble quest, the use of qualitative analysis especially phenomenological descriptions may prove to be a fruitful line of research.

Over recent years the growth in research into metacognition has continued. Now research on metacognition can be found throughout the fields of psychology, education, neuroscience and health. With the establishment of a special interest group in metacognition in Europe and a new journal dedicated to research on metacognition and learning, (Veenman, 2005), it seems likely that this area of research will continue to grow.

As John Flavell suggested in 1979, research into metacognition and cognitive monitoring may help us to teach children and adults :

> "to make wise and thoughtful life decisions as well
> as to comprehend and learn better in formal educational
> settings". (p.910)

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APPENDIX 4.1

METACOGNITION (Pilot Test Scoring)

Name of child ....

Name of school ....

Name of teacher ....

Child age/gender ....

Score conservation ....Score drawing ....

MENTAL ROTATION

CATEGORIES:
NON-MENTAL: 0
GENERAL MENTAL: 1
MENTAL ROTATION: 2

CARD 2

ROTATE

Q1: HOW DID YOU DO THAT? / HOW DID YOU WORK THAT OUT?

Q2: WHAT WAS DIFFICULT ABOUT IT? / WHAT WAS EASY ABOUT IT?

Q3: CAN YOU TELL ME WHAT YOU SAID TO YOURSELF WHEN YOU WERE DOING IT?

Q4: CAN YOU TELL ME WHAT THINGS YOU THOUGHT ABOUT TO HELP YOU DO THIS?

CARD 3

ROTATE:

Q1: HOW DID YOU DO THAT? / HOW DID YOU WORK THAT OUT?

Q2: WHAT WAS DIFFICULT ABOUT IT? / WHAT WAS EASY ABOUT IT?

Q3: CAN YOU TELL ME WHAT YOU SAID TO YOURSELF WHEN YOU WERE DOING IT?

Q4: CAN YOU TELL ME WHAT THINGS YOU THOUGHT ABOUT TO HELP YOU DO THIS?

<u>CARD 4</u>

ROTATE:

Q1: HOW DID YOU DO THAT? / HOW DID YOU WORK THAT OUT?

Q2: WHAT WAS DIFFICULT ABOUT IT? / WHAT WAS EASY ABOUT IT?

Q3: CAN YOU TELL ME WHAT YOU SAID TO YOURSELF WHEN YOU WERE DOING IT?

Q4: CAN YOU TELL ME WHAT THINGS YOU THOUGHT ABOUT TO HELP YOU DO THIS?

APPENDIX 4.2

TEACHER INTERVIEWS (sept/oct 99)

Research Question:

2) What aspects of teacher intervention are important in the development of metacognition.

Interviews (1) (sept/oct 99)

Trying to find out:

a) Extent of teacher's knowledge of the theory of metacognition
b) Teacher's attitude to the importance of this theory for learning

Interviews (2) (Jul 00)

Trying to find out:

a) Has teacher's knowledge of the theory of metacognition developed in any way
b) Has their attitude to its importance for learning changed

Analysis

a) Score knowledge of theory, by placing each teacher in a category described by what they say about the theory and their familiarity with it.
b) Analyse answers that show their attitude to the importance of metacognition for learning
c) Analyse attitude to other aspects of teaching (using their own words as descriptors)

It should be possible to test their perceived attitudes to learning by observing them in practice. It should also be possible to see if there is any correlation between the teacher's beliefs about the development of metacognition and any actual development shown by the children.

APPENDIX 4.2

INTERVIEW SCHEDULE (1) (PILOT & September 1999)

Preamble:

I am working on a project with year one children that sets problem solving activities to be worked on in groups of six. The project is researching whether this approach will develop children's thinking skills over a year. My particular interest is in the development of children's thinking and the teaching strategies that may influence it.

I would like to tape-record the interview with your permission because it will give me a more accurate record than taking notes. The comments you make will be in total confidence and your name will not appear on any typed transcripts of the tape or in any subsequent reports. The findings of my research will be produced along with the findings from the full CASE project and I expect you will get to see this report when all the data is analysed and written up.

Before we begin do you have any questions you want to ask me about the interview procedure itself.

Q1: Can you tell me how long you have been teaching

Q2: How would you describe your approach to teaching
(Prompt: Do you feel you fall into any particular category of teaching style)

Q3: What would you say are the most important aspects of teaching yr1 children
(probe: Can you say any more about this)

Q4: If you had to give advice to an NQT of yr1 children what would you tell them to focus on
(probe: anything else)

Q5: During your own teacher training or other P.D. did you come across the theory of metacognition

If yes:

a) can you explain the context in which this was described
b) can you explain your understanding of the term

If no:
Give explanation:
The term is controversial in that different people take it to mean slightly different things. I am using to mean basically the ability to think about your own thinking, to see yourself as an active thinker. To know that you know something or to understand that don't understand something and to be able to explain your thinking to others. An eg. Of metacognition might be:
"I thought I didn't know the answer, but then I remembered something from another lesson and then I realised I could work out the answer" or "I had to stop and ask myself what I was doing wrong"
With a younger age group we might see the beginnings of metacognition in any statements about thinking things out, or using my brain to work it out or planning how to do something.

Q6: Is there anything I've said in this explanation that resonates with you as being important for your children's learning

Q7: Can you think of any egs from your own teaching of children showing a metacognitive ability

Q8: Is this type of thinking something that is promoted in classrooms in your experience
(probe: Should it be promoted more)

Q9: Are there any teaching strategies you use to promote it

Q10: Are there any aspects of metacognition that might have helped you in your own studies.

Q11: Do you think metacognition can be taught

End
That's all *my* questions, thank you. Is there anything you would like to add.
(pause)

Is there anything you would like to ask me.

Thank you very much for your time.

APPENDIX 6.1

METACOGNITION TESTS – GAIN SCORES

Experimental

school	pupil	as learner	metamem	rotation
A	1	1	4	0
	2	-1	6	0
	3	0	4	0
	4	0	7	0
B	5	0	4	0
	6	1	3	0
	7	0	2	0
	8	1	6	0
	9	0	7	0
	10	0	3	0
C	11	0	7	0
	12	0	4	0
	13	0	6	0
	14	0	5	1
	15	1	3	1
	16	0	3	1
D	17	1	5	0
	18	1	2	0
	19	1	7	2
	20	1	7	0
	21	1	5	2
mean		0.38	4.76	0.33

Control

school	pupil	as learner	metamem	rotation
X	22	1	1	1
	23	1	0	-1
	24	0	4	0
	25	0	7	-1
	26	0	3	1
Y	27	0	-5	0
	28	1	0	1
	29	1	0	0
	30	1	0	2
	31	1	-1	0
	32	0	1	0
Z	33	1	6	2
	34	1	0	2
	35	1	4	-1
	36	0	1	-1
	37	0	3	0
Mean		0.56	1.50	0.31

APPENDIX 7.1

Field Notes – School A December 1999 – giant story

My third visit to this classroom and so far I've been struck by the sense of order and calm. On arrival the class was assembling together on the carpet with the teacher at the front. They were singing a little song that brought them quickly together and focused on the teacher. A classroom assistant was also present. Most of the children were smiling and appeared to be listening attentively to the teacher. Various activities had been planned, finishing art work, some work sheets from yesterday, a science activity about floating and sinking. The children were given very clear instructions about what to do and what to do if they finished early – read or draw at your table.

There is still only 19 children in this class, the rest move up after Christmas. Teacher tells me she is a bit apprehensive, since she has settled this group well and thinks the new children could be disruptive.

The CASE group join my table. The brightly coloured story cards are on the table. The children immediately begin looking at them, but wait for the teacher before picking any up.

Concrete preparation – short and clear. Largely child led. Each child chose a picture and pointed to something they noticed in it. A few words were clarified eg. fork, giant, castle. The goal – to make a story – was presented clearly.

All children engaged in the task. Teacher tended to emphasise sharing and being kind to each other. Sarah tried to dominate again, but she gave way without crying.

They took turns to move the cards around, but at times they worked together, discussing amongst themselves what to do next. It was difficult to hear all this and I hope the tape has recorded it.

Some attempt at metacognition at end especially TV, but not much at all. Children seemed to be engaged in the task, but teacher doesn't really engage in FM.

Interruption by another teacher near end of lesson means CASE activity cut a bit short, children left to tidy up.

School seems very calm even at end of day. I seem to get along well with the teacher. She has a child 1 year younger than mine and we spent ten mins at end discussing play groups rather than the research. She is interested in metacognition though and told me that one of her relatives is a psychologist.

APPENDIX 7.2 FREQUENCY COUNT TABLES

Table A.7.4 Teacher F.M. Behaviours – Experimental School A Autumn Term

Code/Task	Flowers	Dinosaurs	Giant Story	Buttons	Totals
TS	0	0	0	0	0
TK	10	2	0	1	13
TI	0	0	0	0	0
TE	3	0	0	2	5
TQ	10	2	0	7	19
TP	0	0	0	0	0
TL	2	0	0	2	4
TO	3	1	1	2	7
TC	3	0	0	1	4
TT	7	2	1	6	16
TU	1	6	2	0	9
TV	1	0	2	2	5
Totals	40	13	6	23	82

Average 20.5

Table A.7.5 Teacher F.M. Behaviours – Experimental School A Spring Term

Code/Task	Boxes	Shapes	Crossroads	Race	Clowns	Totals
TS	1	0	0	0	3	4
TK	3	0	1	1	0	5
TI	1	0	0	0	0	1
TE	0	0	0	0	0	0
TQ	6	0	8	0	0	14
TP	0	0	0	0	0	0
TL	3	0	0	0	0	3
TO	0	0	4	0	2	6
TC	0	0	0	0	1	1
TT	3	2	4	3	3	15
TU	0	0	1	0	0	1
TV	0	0	1	0	0	1
Totals	17	2	19	4	9	51

Average 10.2

Table A.7.6 Teacher F.M. Behaviours – Experimental School A Summer Term

Code/Task	Transport	Bottles	Farmyard	Totals
TS	0	1	0	1
TK	9	2	2	13
TI	0	0	0	0
TE	1	1	0	2
TQ	5	0	0	5
TP	0	3	0	3
TL	0	1	0	1
TO	0	0	0	0
TC	1	2	0	3
TT	6	10	5	21
TU	0	0	0	0
TV	0	2	0	2
Totals	22	22	7	51

Average 17

Table A.7.7 Teacher F.M. Behaviours – Experimental School B Autumn Term

Code/Task	Flowers	Animals	Buttons	Giant	Totals
TS	0	0	0	0	0
TK	1	0	0	0	1
TI	0	0	0	0	0
TE	0	0	0	0	0
TQ	4	0	1	0	5
TP	1	0	0	0	1
TL	1	0	0	0	1
TO	1	0	0	1	2
TC	0	0	4	0	4
TT	0	3	14	3	20
TU	0	0	0	0	0
TV	1	0	2	2	5
Totals	9	3	21	6	39

Average 9.75

Table A.7.8 Teacher F.M. Behaviours – Experimental School B Spring Term

Code/Task	Rocks	Shapes	Crossroads	Clowns	Bottles	Totals
TS	0	0	0	0	0	0
TK	0	0	0	1	3	4
TI	0	0	0	0	0	0
TE	0	1	0	0	3	4
TQ	4	0	3	3	0	10
TP	0	0	0	0	0	0
TL	6	0	0	2	0	8
TO	0	1	0	1	0	2
TC	3	3	1	1	0	8
TT	4	12	4	10	9	39
TU	0	0	0	0	0	0
TV	0	1	0	6	4	11
	17	18	8	24	19	86

Average 17.2

Table A.7.9 Teacher F.M. Behaviours – Experimental School B Summer Term

Code/Task	Transport	Farmyard	Shadow	Totals
TS	0	0	0	0
TK	0	0	2	2
TI	0	0	0	0
TE	0	0	0	0
TQ	1	0	0	1
TP	0	0	0	0
TL	0	0	1	1
TO	0	0	0	0
TC	1	3	2	6
TT	8	2	8	18
TU	0	0	0	0
TV	0	2	2	4
Totals	10	7	15	32

Average 10.6

Table A.7.10 Teacher F.M. Behaviours – Experimental School C Autumn Term

Code/Task	Marble Run	Buttons	Shapes	Giant	Totals
TS	0	0	0	0	0
TK	2	0	2	0	4
TI	0	0	0	0	0
TE	0	0	0	0	0
TQ	4	2	4	4	14
TP	0	0	0	0	0
TL	0	0	0	0	0
TO	0	0	0	0	0
TC	0	1	0	0	1
TT	2	1	3	2	8
TU	0	1	0	0	1
TV	0	0	0	0	0
Totals	8	5	9	6	28

Average 7

Table A.7.11 Teacher F.M. Behaviours – Experimental School C Spring Term

Code/Task	Rocks	Cook Story	Crossroads	Race	Bottles	Totals
TS	0	0	0	0	0	0
TK	0	1	9	5	3	18
TI	0	0	0	0	0	0
TE	0	0	0	0	0	0
TQ	14	1	0	4	0	19
TP	0	0	0	0	0	0
TL	2	0	0	0	0	2
TO	0	0	0	0	0	0
TC	0	0	1	0	0	1
TT	0	2	2	4	0	8
TU	1	0	0	0	0	1
TV	1	0	3	2	1	7
Totals	18	4	15	15	4	56

Average 11.2

Table A.7.12 Teacher F.M. Behaviours – Experimental SchoolC Summer Term

Code/Task	Shadows	Transport	Farmyard	Totals
TS	0	0	0	0
TK	1	0	1	2
TI	0	0	0	0
TE	0	0	0	0
TQ	2	3	0	5
TP	0	0	0	0
TL	0	0	0	0
TO	0	0	0	0
TC	0	0	0	0
TT	5	2	1	8
TU	0	0	0	0
TV	1	0	0	1
Totals	9	5	2	16

Average 5.3

Table A.7.13 Teacher F.M. Behaviours–Experimental School D Autumn Term

Code/Task	Marble Run	Shapes	Buttons	Giant	Totals
TS	0	0	0	0	0
TK	2	1	2	2	7
TI	6	1	1	0	8
TE	2	2	3	3	10
TQ	9	8	6	7	30
TP	0	0	2	0	2
TL	1	0	1	1	3
TO	0	0	0	0	0
TC	0	0	0	0	0
TT	2	3	4	8	17
TU	0	0	0	0	0
TV	0	0	5	4	9
Totals	22	15	24	25	86

Average 21.5

Table A.7.14 Teacher F.M. Behaviours–Experimental School D Spring Term

Code/Task	Rocks	Cook Story	Crossroads	Race	Bottles	Totals
TS	0	0	0	0	0	0
TK	3	0	3	8	0	14
TI	3	0	1	0	0	4
TE	0	2	0	1	0	3
TQ	5	12	1	1	0	19
TP	2	1	0	0	0	3
TL	0	1	0	1	3	5
TO	0	0	0	0	0	0
TC	1	0	0	0	0	1
TT	1	3	5	6	4	19
TU	0	0	1	0	0	1
TV	5	2	1	3	5	16
Totals	20	21	12	20	12	85

Average 17

Table A.7.15 Teacher F.M. Behaviours–Experimental School D Summer Term

Code/Task	Shadows	Transport	Farmyard	Totals
TS	0	0	0	0
TK	6	0	4	10
TI	0	0	0	0
TE	0	0	0	0
TQ	0	1	0	1
TP	0	0	0	0
TL	0	0	0	0
TO	0	0	0	0
TC	0	0	0	0
TT	11	2	4	17
TU	0	0	0	0
TV	3	2	0	5
Totals	20	5	8	33

Average 11

Table A.7.16 Teacher F.M. Behaviours, Totals for the Year – Control School Numeracy lessons

Code/Sch	School X	School Y	School Z	Totals
TS	0	0	0	0
TK	1	1	8	10
TI	0	0	0	0
TE	2	0	0	2
TQ	12	1	0	13
TP	0	0	0	0
TL	0	0	0	0
TO	0	0	0	0
TC	0	0	0	0
TT	7	3	11	21
TU	0	1	0	1
TV	3	1	13	17
Totals	25	7	32	64

Tables A.7.17 Teacher F.M. Behaviours,Totals for the Year –Experimental Schools Case and Numeracy lessons

Code/Sch	School A		School B		School C		School D		Totals	
CA/Num	CA	NU	CA	NU	CA	NU	CA	NU	CA	NU
TS	5	2	0	0	0	0	0	0	5	2
TK	31	5	7	5	24	5	31	12	93	27
TI	1	0	0	0	0	0	12	0	13	0
TE	7	2	4	0	0	0	13	2	24	4
TQ	38	3	16	11	38	4	50	11	142	29
TP	3	0	1	0	0	0	5	0	9	0
TL	8	2	10	0	2	0	8	3	28	5
TO	13	4	4	1	0	2	0	0	17	7
TC	8	0	18	2	2	0	1	0	29	2
TT	52	8	77	15	24	9	53	7	206	39
TU	10	1	0	2	2	0	1	0	13	3
TV	8	4	20	0	8	2	30	4	66	10

Table A.7.18 Child M Behaviours–Experimental School A Autumn Term

Code/Task	Flowers	Dinosaurs	Giant Story	Buttons	Totals
SELF	5	7	2	3	17
OTH	0	0	1	1	2
UNIV	0	0	0	0	0
UND	1	0	0	0	1
PRED	0	1	0	0	1
RAT	1	0	3	2	6
COMP	2	1	0	0	3
EVA	7	2	3	2	14
PLAN	1	0	0	0	1
PAR	0	0	0	0	0
SQU	2	3	0	0	5
CHE	3	0	0	2	5
Totals	22	14	9	10	55

Average 13.75

Table A.7.19 Child M Behaviours–Experimental School A Spring Term

Code/Task	Boxes	Shapes	Crossroads	Race	Clowns	Totals
SELF	3	0	1	0	4	8
OTH	0	0	1	1	0	2
UNIV	0	0	0	0	0	0
UND	0	0	1	0	1	2
PRED	0	0	0	0	0	0
RAT	0	0	1	0	0	1
COMP	3	0	0	1	0	4
EVA	7	0	4	0	3	14
PLAN	0	0	0	0	1	1
PAR	0	0	0	0	0	0
SQU	0	0	0	0	0	0
CHE	0	0	2	0	0	2
Totals	13	0	10	2	9	34

Average 6.8

Table A.7.20 Child M Behaviours–Experimental School A Summer Term

Code/Task	Transport	Bottles	Farmyard	Totals
SELF	1	2	1	4
OTH	0	0	1	1
UNIV	0	1	0	1
UND	0	0	0	0
PRED	0	0	0	0
RAT	0	1	0	1
COMP	2	0	0	2
EVA	1	4	1	6
PLAN	0	0	0	0
PAR	0	0	0	0
SQU	0	0	0	0
CHE	0	0	0	0
Totals	4	8	3	15

Average 5

Table A.7.21 Child M Behaviours–Experimental School B Autumn Term

Code/Task	Flowers	Animals	Buttons	Giant Story	Totals
SELF	0	1	9	5	15
OTH	0	3	6	4	13
UNIV	0	0	0	0	0
UND	1	0	0	0	1
PRED	0	0	0	0	0
RAT	0	1	1	2	4
COMP	1	0	0	2	3
EVA	2	5	14	5	26
PLAN	0	0	0	2	2
PAR	0	0	0	0	0
SQU	0	0	0	0	0
CHE	0	0	2	2	4
Totals	4	10	32	22	68

Average 17

Table A.7.22 Child M Behaviours–Experimental School B Spring Term

Code/Task	Rocks	Shapes	Crossroads	Clowns	Bottles	Totals
SELF	6	4	5	5	8	28
OTH	0	3	0	2	1	6
UNIV	0	0	0	0	0	0
UND	0	0	2	2	4	8
PRED	1	0	0	2	0	3
RAT	0	0	0	7	5	12
COMP	0	1	5	4	5	15
EVA	6	0	1	12	2	21
PLAN	5	0	0	5	0	10
PAR	0	0	0	0	0	0
SQU	0	0	0	0	0	0
CHE	0	0	2	0	0	2
Totals	18	8	15	39	25	105

Average 21

Table A.7.23 Child M Behaviours–Experimental School B Summer Term

Code/Task	Transport	Farmyard	Shadows	Totals
SELF	2	2	2	6
OTH	0	2	3	5
UNIV	0	0	0	0
UND	1	0	1	2
PRED	0	0	0	0
RAT	0	3	1	4
COMP	0	0	0	0
EVA	2	2	1	5
PLAN	0	1	0	1
PAR	0	0	0	0
SQU	0	0	0	0
CHE	0	0	0	0
Totals	5	10	8	23

Average 7.6

Table A.7.24 Child M Behaviours–Experimental School C Autumn Term

Code/Task	Marble Run	Buttons	Shapes	Giant Story	Totals
SELF	1	2	1	3	7
OTH	1	1	0	2	4
UNIV	0	0	0	0	0
UND	0	0	0	0	0
PRED	0	0	0	0	0
RAT	0	0	2	0	2
COMP	0	0	0	0	0
EVA	0	8	0	2	10
PLAN	0	0	0	0	0
PAR	0	0	0	0	0
SQU	0	0	0	0	0
CHE	1	2	0	0	3
Totals	3	13	3	7	26

Average 6.5

Table A.7.25 Child M Behaviours–Experimental School C Spring Term

Code/Task	Rocks	Cook Story	Crossroads	Race	Bottles	Totals
SELF	1	5	0	1	2	9
OTH	2	2	0	1	0	5
UNIV	0	0	0	0	0	0
UND	0	0	0	0	0	0
PRED	0	0	0	0	0	0
RAT	0	0	2	0	2	4
COMP	0	0	0	0	0	0
EVA	2	3	0	0	0	5
PLAN	0	0	0	0	0	0
PAR	0	0	0	0	0	0
SQU	0	0	0	0	0	0
CHE	2	3	4	1	7	17
Totals	7	13	6	3	11	40

Average 8

Table A.7.26 Child M Behaviours–Experimental School C Summer Term

Code/Task	Shadow	Transport	Farmyard	Totals
SELF	1	1	1	3
OTH	3	1	0	4
UNIV	0	0	0	0
UND	0	0	0	0
PRED	0	0	0	0
RAT	0	0	0	0
COMP	0	0	0	0
EVA	0	0	0	0
PLAN	0	0	0	0
PAR	0	0	0	0
SQU	0	0	0	0
CHE	0	1	0	1
Totals	4	3	1	8

Average 2.6

Table A.7.27 Child M Behaviours–Experimental School D Autumn Term

Code/Task	Marble Run	Shapes	Buttons	Giant Story	Totals
SELF	0	0	5	3	8
OTH	1	0	0	1	2
UNIV	0	0	0	0	0
UND	0	0	0	0	0
PRED	0	0	0	0	0
RAT	0	0	1	8	9
COMP	0	0	2	1	3
EVA	7	2	3	3	15
PLAN	4	1	0	3	8
PAR	0	0	0	0	0
SQU	0	0	0	0	0
CHE	0	0	0	1	1
Totals	12	3	11	20	46

Average 11.5

Table A.7.28 Child M Behaviours–Experimental School D Spring Term

Code/Task	Rocks	Cook Story	Crossroads	Race	Bottles	Totals
SELF	0	3	3	0	0	6
OTH	0	1	1	0	0	2
UNIV	0	2	0	0	0	2
UND	0	0	1	0	0	1
PRED	0	0	0	0	0	0
RAT	5	1	0	1	2	9
COMP	0	4	1	2	1	8
EVA	2	7	1	0	1	11
PLAN	0	1	0	3	0	4
PAR	0	0	0	0	0	0
SQU	1	2	0	0	0	3
CHE	0	0	2	0	0	2
Totals	8	21	9	6	4	48

Average 9.6

Table A.7.29 Child M Behaviours–Experimental School D Summer Term

Code/Task	Shadows	Transport	Farmyard	Totals
SELF	2	2	5	9
OTH	0	1	1	2
UNIV	0	0	0	0
UND	0	0	2	2
PRED	0	0	0	0
RAT	0	4	2	6
COMP	3	2	0	5
EVA	0	3	1	4
PLAN	0	0	0	0
PAR	0	0	0	0
SQU	0	0	0	0
CHE	0	0	0	0
Totals	5	12	11	28

Average 9.3

Table A.7.30 Child M Behaviours, Totals for the Year – Control Schools, Numeracy lessons

Code/Sch	School X	School Y	School Z	Totals
SELF	7	5	13	25
OTH	6	2	1	9
UNIV	0	0	1	1
UND	0	1	0	1
PRED	0	0	1	1
RAT	5	2	7	14
COMP	3	1	1	5
EVA	12	2	1	15
PLAN	0	0	0	0
PAR	0	0	0	0
SQU	0	1	0	1
CHE	6	1	2	9
Totals	39	15	27	81

Table A.7.31 Child M Behaviours, Totals for the Year – Experimental Schools, CASE and Numeracy lessons

Code/Sch	School A		School B		School C		School D		Totals	
CA/Num	CA	Num	CA	Num	CA	Num	CA	Num	CA	Num
SELF	29	7	49	7	19	2	23	2	120	18
OTH	5	5	24	0	13	1	6	0	48	6
UNIV	1	0	0	1	0	0	2	0	3	1
UND	3	1	11	1	0	0	3	0	17	2
PRED	1	0	3	0	0	0	0	0	4	0
RAT	8	2	20	6	6	2	24	1	58	11
COMP	9	0	18	1	0	0	16	2	43	3
EVA	34	7	52	9	15	1	30	5	131	22
PLAN	2	0	13	0	0	0	12	0	27	0
PAR	0	0	0	0	0	0	0	0	0	0
SQU	5	1	0	0	0	0	3	1	8	2
CHE	7	1	6	2	21	0	3	0	37	3
Totals	104	24	196	27	74	6	122	11	496	68

Table A.7.32 Teacher FM and Child M Behaviours in Individual CASE Tasks across all Schools

Task	Observed in Schools	Total Teacher Behaviours	Total Student Behaviours
Shapes	A,B.C,D *	44	14
Buttons	A,B,C.D *	73	66
Giant Story	A,B,C,D *	43	58
Cook Story	C,D	25	34
Rocks	B,C,D	55	33
Crossroads	A,B,C,D *	54	40
Race	A,C,D	39	11
Bottles	A,B,C,D *	57	48
Shadows	B,C,D	44	17
Transport	A,B,C,D *	42	24
Farmyard	A,B,C,D *	24	25
Flowers	A,B	49	26
Dinosaurs	A	13	14
Boxes	A	17	13
Clowns	A,B	33	48
Animals	B	3	10
Marble Run	C,D	30	15

Table A.7.33 Teacher FM Behaviours and Child M Behaviours in Buttons Task across all Schools

School	Most Frequent Teacher Behaviours	Total T	Most Frequent Student Behaviours	Total S
A	TQ – 7 TT – 6 (others combined 10)	23	Self – 5, Oth – 1, Rat –2, Eva – 2	10
B	TC – 4 TT – 14 (others combined 3)	21	Eva – 14, Self – 9, Oth – 6, Che –2, Rat –1	32
C	TQ – 2 TT – 5	7	Eva – 8, Self – 2, Oth – 1, Che –2	13
D	TQ – 6 TT – 4 (others combined 14)	24	Self – 5, Eval – 3, Pred – 1, Comp – 2	11

Table A.7.34 Teacher FM Behaviours and Child M Behaviours in Experimental School Numeracy lessons and Control School Numeracy Lessons

Observations: 3 numeracy lessons in each experimental school = 12
3 numeracy lessons in each control school = 9

Total Behaviours over the Year

School	Child Behaviours	Teacher Behaviours
A (Exp)	24	29
B (Exp)	27	36
C (Exp)	6	22
D (Exp)	11	34
X (Cont)	37	25
Y (Cont)	15	7
Z (Cont)	27	22

Table A.7.35 Comparison of Experimental School Child M Behaviours and Control School Child M Behaviours During Numeracy Lessons By Code

Code	School A	School B	School C	School D	School X	School Y	School Z
SELF	7	7	2	2	7	5	13
OTH	5	0	1	0	6	2	1
UNIV	0	1	0	0	0	0	1
UND	1	1	0	0	0	1	0
PRED	0	0	0	0	0	0	1
RAT	2	6	3	2	5	2	7
COMP	0	1	0	2	3	1	1
EVA	7	9	1	5	12	2	1
PLAN	0	0	0	0	0	0	0
PAR	0	0	0	0	0	0	0
SQU	1	0	0	0	0	1	0
CHE	1	2	7	0	6	1	2

Table A.7.36 Comparison of Experimental School Teacher FM Behaviours and Control School Teacher FM Behaviours During Numeracy Lessons By Code

Code	School A	School B	School C	School D	School X	School Y	School Z
TS	2	0	0	0	0	0	0
TK	5	5	5	12	1	1	8
TI	0	0	0	0	0	0	0
TE	2	0	0	2	2	0	0
TQ	3	11	4	11	12	1	0
TP	0	0	0	0	0	0	0
TL	2	0	0	3	0	0	0
TO	4	1	2	0	0	0	0
TC	0	2	0	0	0	0	0
TT	8	15	9	7	7	3	11
TU	1	2	0	0	0	1	0
TV	4	0	2	4	3	1	13

APPENDIX 9.1

Teacher Interviews #2 June/July 2000 – Experimental Schools

Teacher Interviews #2 June/July 2000

As you know this is the second interview. The first one being last September. In this interview I would like to concentrate a little more on the concept of metacognition. I am interested in your views, thoughts and opinions on this, it is not a test to see how much you know about the theory. I am particularly interested in examples and stories you may have from your own classroom.

With your permission I would like to tape record the interview, because it is more accurate than taking notes. The comments you make will be in total confidence and your name or the name of your school will not appear on any typed transcripts. I hope to be able to provide you with summary report of my research when all the data has been analysed and written up.

Before we begin is there anything you would like to ask me about the interview procedure itself.

Q1. Last time we talked you mentioned (speaking & listening) skills as being one of the most important aspects of teaching Yr. 1 children. Have your views changed in anyway since then.

Probe: Why do you think that now

Q2. How has your own teaching style changed since the last time we spoke

Probe: Can you give an examples

Q3. How has your understanding of metacognition changed since the last interview

Probe: How has the changed come about

Q4. How would you define metacognition now

Probe: What do you think are the most important aspects to emphasise

Q5. Have you any stories or egs. of metacognition from this year group

Q6. **Could you give me egs. of the questions you ask in CASE lessons to facilitate metacognition**

Q7. **What has been your experience of the response to these questions**

Probe: Can you give any egs.
Probe: How does it work for different abilities.

Q8. **What affect do you think this type of questioning has had on your teaching style.**

Q9. **Do you see any benefits to pursuing metacognition with young children**

Probe: Any stories to relate about this

Q10. **How much help and instruction have you had in understanding the construct of metacognition**

Probe: Has this been enough

Probe: What would you like to have had

Q11. **What obstacles have you found to promoting metacognition**

Q12. **How do you see promoting metacognition fitting in with the National Curriculum**

Q13. **Is there anything you want to add**
Is there anything you want to ask me

Thank you for agreeing to the interview.

APPENDIX 9.2

TEACHER F M BEHAVIOURS – SUMMER TERM, CASE TASKS
TABLE A.9.3

	TRANSPORT TASK				FARMYARD TASK				BOTTLES/SHADOWS				TOTALS			
CODE/	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
TS	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
TK	9	0	0	0	2	0	1	4	2	2	1	6	13	2	2	10
TI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TE	1	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0
TQ	5	1	3	1	0	0	0	0	0	0	2	0	5	1	5	1
TP	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0
TL	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0
TO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TC	1	1	0	0	0	3	0	0	2	2	0	0	3	6	0	0
TT	6	8	2	2	5	2	1	4	10	8	5	11	21	18	8	17
TU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TV	0	0	0	2	0	2	0	0	2	2	1	3	2	4	1	5
totals	22	10	5	5	7	7	2	8	22	15	9	20	51	32	16	33

APPENDIX 9.3

CHILD M BEHAVIOURS – SUMMER TERM, CASE TASKS
TABLE A.9.4

	TRANSPORT TASK				FARMYARD TASK				BOTTLES/SHADOWS				TOTALS			
CODE/ SCHOOL	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
SELF	1	2	1	2	1	2	1	5	2	2	1	2	4	6	3	9
OTH	0	0	1	1	1	2	0	1	0	3	3	0	1	5	4	2
UNIV	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
UND	0	1	0	0	0	0	0	2	0	1	0	0	0	2	0	2
PRED	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RAT	0	0	0	4	0	3	0	2	1	1	0	0	1	4	0	6
COMP	2	0	0	2	0	0	0	0	0	0	0	3	2	0	0	5
EVA	1	2	0	3	1	2	0	1	4	1	0	0	6	5	0	4
PLAN	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
PAR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SQU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CHE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
totals	4	5	3	12	3	10	1	11	8	8	4	5	15	23	8	28

APPENDIX 9.4

TEACHER F M AND CHILD M BEHAVIOURS – SUMMER TERM, NUMERACY LESSONS
TABLE A.9.5

ONE NUMERACY LESSON OBSERVED IN EACH SCHOOL IN SUMMER TERM 2000

CODE/ TEACHER	A	B	C	D	X	Y	Z	CODE/ STUDENT	A	B	C	D	X	Y	Z
TS	0	0	0	0	0	0	0	SELF	2	2	1	1	3	0	2
TK	2	1	0	1	0	1	3	OTH	2	0	0	0	2	0	0
TI	0	0	0	0	0	0	0	UNIV	0	0	0	0	0	0	0
TE	0	0	0	0	0	0	0	UND	1	0	0	0	0	0	0
TQ	2	1	0	0	3	0	0	PRED	0	0	0	0	0	0	0
TP	0	0	0	0	0	0	0	RAT	1	3	1	1	1	0	4
TL	0	0	0	0	0	0	0	COMP	0	1	0	0	1	0	1
TO	1	0	0	0	0	0	0	EVA	2	3	0	2	3	0	1
TC	0	2	0	0	0	0	0	PLAN	0	0	0	0	0	0	0
TT	2	6	4	3	3	0	2	PAR	0	0	0	0	0	0	0
TU	0	0	0	0	0	0	0	SQU	0	0	0	1	0	0	0
TV	0	0	0	2	0	1	4	CHE	0	1	0	0	0	0	0
TOTALS	7	10	4	6	6	2	9		8	10	2	5	10	0	8